US ARMY SIGNAL CENTER AND FORT GORDON
Fort Gordon. Georgia 30905-5180

LESSON PLAN

TITLE: AN/TYC-39A Disk Drives

LEARNING OBJECTIVE:

Action: The student will operate, adjust, fault isolate and repair the Floppy Disk Drive (FDD) and Storage Drive System (SDS) which will include removal and replacement procedures.

Conditions: The student is given a AN/TYC-39A, Student Guide, TM-11-5805-790-12-1, TM-11-5805-790-12-7, TM-11-5805-790-34, TM-11-5895-1468-34, and Performance Exercises 74G10/G01-LP01-PE.

Standard: The student has met the learning objective when he/she fault isolates 2 of 3 malfunctions within 30 minutes per fault and correctly answered 14 out of 20 questions within 1 hour.

SAFETY CONSIDERATIONS: DANGER. High voltages are present in this equipment. Remove all jewelry before working on the equipment.

RISK ASSESSMENT: A risk assessment has been conducted on this unit of instruction and the risk level is deemed to be: LOW RISK.

RESOURCE NEEDS/ REFERENCES: Overhead Projector, Transparency 1 through 13, Student Guide, Whiteboard, AN/TYC-39A, TM 11-5805-790-12-1, TM 11-5805-790-12-7, TM 11-5805-790-12-8, TM-11-5805-790-34 and Practical Exercise--150-74G10/G01-LP01-PE.

APPROVAL DATE: DEC 11,1997
DEVELOPER: SSG Shank
DIV. CHIEF: Jack P. Rondon

METHOD OF
INSTRUCTION: Conference and Practical exercise

TIME: 16.0 Hours

INSTRUCTOR NOTES:

1. Ensure that the classroom is available and properly set up and that all equipment and training resources are available and in working order.
2. Ensure that enough technical manuals and Student Guides are available and account for all transparencies.
3. Before the end of class, evaluate students on their ability to perform the learning objective.
4. State all safety notes as they appear throughout the lesson plan.

ELAPSED TIME:

INTRODUCTION:

1. To successfully maintain the AN/TYC-39A, you need a good working knowledge of the AN/TYC-39A disk drives. The drives are used to store and load system programs, diagnostic programs, data base files and message files. Each drive is interfaced with a corresponding disk controller.

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BODY:

1. Physical/Functional Description - Dual Floppy Disk Drive (DFDD).

NOTES: Show Slide 1.

2. Explain to students that the Army refers to this unit as a disk drive unit; however, in this lesson and in all technical manuals, it is referred to as the Dual Floppy Disk Drive (DFDD).

   a. DFDD Functions.

      (1) Perform message switch program load.

(2) Apply/update database on the message switch program load device.

(3) Read/write database files.

b. DDU Components.

(1) Two 3.5-inch Floppy Disk Drive (FDD) Units.
(2) Two +28 Vdc DC-to-DC converter circuit boards.
(3) Two Small Computer System Interfaces (SCSI)

c. Characteristics.

(1) Operating Current - The operating current requirement of each FDD shall not exceed one ampere with 28 Vdc applied at 25 degrees centigrade.
(2) Turn-on Current - The turn-on current for the DDU shall not exceed 2 amperes for more than 10 seconds with 28 Vdc applied at 25 degrees centigrade.
(3) Input Voltage - 28 Vdc.

(a) MIN 21 Vdc.
(b) MAX 32 Vdc.
(c) Ripple - Shall not exceed 1 VP-P at 282 to 2520 Hz.

(4) Disk Capacity.

(a) An unformatted, double-sided, high-density disk has a capacity of two Megabytes.
(b) The DDU will format the disks using SCSI commands.
(c) Sector Size - 512 bytes
(d) Number of Tracks - 80 tracks per side x 2 sides = 160 tracks.
(e) Recording Density - 17,434 Bits Per Inch (BPI) maximum.
(f) Track Density - 135 Tracks Per Inch (TPI).

(5) Data Transfer Rates.

(a) SCSI Data Transfer Rate - 1.5 Mbytes per second.
(b) Media Data Transfer Rate - 500 kb/s minimum.

(6) Access Time.

(a) Per track is 6 msec; without settling time.
(b) Average is 160 msec; without settling time.
(c) Settling time is 15 msec.

(7) Reliability.

(a) Read Error; 1 error in 10^9 bits related to software and 1 error in 10^{12} bits related to hardware.
(b) Seek Error; 1 error in 10^6 bits.
(c) Disk Life; 3 x 10^6; with head loaded 30,000 insertions.
(d) Mean Time Before Failure (MTBF) is 10,000 hours over the full temperature range.
(e) Mean Time to Repair (MTTR) is 30 minutes.

d. Environmental Conditions.

(1) Pressure Altitude.

(a) Operational range is sea level to 10,000 feet.
(b) Non-operational range is sea level to 40,000 feet with a rate of altitude not exceeding 2500 feet per minute.

(2) Temperature.

(a) Low Temperature.

1. Startup - The DDU is capable of being energized at -5°C (FDD mass temperature without damage.
2. Operating - The DDU is fully operational when energized at -5°C.

3. Non-operating - The low temperature limit is -55°C.

(b) High Temperature.

1. Operating - The DDU is capable of operating without degradation up to +48.9°C.
2. Non-operating - The high temperature limit is +71.1°C.

(c) Humidity - The DDU is operable without degradation of specified performance, and sustains no physical damage during or after prolonged exposure to relative humidity of 10 to 90%, non-condensing.

NOTE: Recapitulate key points. Ask questions to ensure student's understanding of material covered.

QUESTIONS: What type of floppy disk is used in the FDD? (ANS: Double Sided, High Density 3.5).

How many FDDs are there in the message switch?
(ANS: Two).

What type of interface is used in the FDD?
(ANS: SCSI).

What is the input voltage of the FDU?
(ANS: 28 Vdc).

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2. DDU Controls and Indicators.

a. Power.

(1) CB1 - Applies power to drive A.
(2) CB2 - Applies power to drive B.

b. Each drive has the following indicators:

(1) Ready (RDY) - Lights green to indicate that the drive is ready for access.

(2) Busy (BSY) - Lights yellow to indicate that the drive is currently in use.

c. Lamp Test - When pressed, lights both the RDY and BSY indicators for the drive being tested.

3. Dual Floppy Disk Drive (DFDD) Functional Block Diagram

NOTE: Show Slide 2 and 3 Refer students to TM 11-5805 790-34-3 sheet 9 of 12, page 6-12.

a. J3 - Power Connector.

(1) Plug MS27656T 13F 4P type connector.
(2) 4-pin connector; pins assigned as follows:

(a) Chassis ground.
(b) +28 Vdc.
(c) +28 Vdc return.
(d) Spare.

b. J4 - Power Connector.

(1) Plug MS27656T 13F 4P type connector.
(2) 4-pin connector; pins assigned as follows:

(a) Chassis ground.
(b) +28 Vdc.
(c) +28 Vdc return.
(d) Spare.

c. J1 SCSI Interface Connector.

(1) Socket MS27505E 17F 35S type connector.
(2) Connects the IOSL card to the FDD.

d. J2 - SCSI Interface Connector.

(1) Socket MS27505E 17F 35S type connector.
(2) Connects the IOSL card to the FDD.
(3) SCSI interface signals between the IOSL, the DDU, and the FDD are as follows.

(a) Busy (BSY) - An OR-TIED signal that indicates that the bus is being used.
(b) Select (SEL) - A signal used by the IOSL to select the FDD.

(c) Command/Data (C/D).

1. A signal driven by the FDD that indicates whether control or data information is on the data bus.
2. True (active) indicates control.

(d) Input/Output (I/O).

1. A signal driven by the FDD that controls the direction of data movement on the data bus with respect to the IOSL.
2. True (active) indicates input to the IOSL.

(e) Message (MSG) - A signal driven by the FDD during the message phase.
(f) Request (REQ) - A signal driven by the FDD to indicate a request for a REQ/ACK data transfer handshake.
(g) Acknowledge (ACK) - A signal driven by the IOSL to indicate an acknowledgment before a REQ/ACK data transfer handshake.
(h) Attention (ATN) - A signal driven by the IOSL to indicate the attention condition.
(i) Reset (RST) - An OR-TIED signal that indicates the reset condition.
(j) Data Bus Parity - DB (P) is odd.
(k) Data Bus 8 (DB 7-0) - Eight data-bit signals form a data bus.

1. DB7 is the most significant bit and has the highest priority during the arbitration phase.
2. Bit number, significance, and priority decrease downward to DB0.
3. A data bit is defined as one when the signal value is true, and is defined as zero when the signal value is false.

(4) Blocks of data are transferred over this asynchronous, 8-bit, parity-detected bus one byte at a time (over eight parallel lines).

NOTE: Recapitulate key points. Ask questions to ensure student understanding of material covered.

QUESTIONS: J4 provides power to which FDU?
(ANS: Drive A).

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4. Fault Isolation.

NOTE: Show Slide 4.

a. The fault detection test initially Master Resets the FDD and returns the IOSL control and buffer status to its normal starting state.
b. If a failure is detected in the device initialization, the test flags and reports it to the MP.
c. Failures to execute the DFDD readiness test or a failure to properly perform either one of the read write FDD commands is also detected and reported to the MP by the FDD device handler.
d. DDU Subsystem Lowest Replaceable Units (LRUs) - The order of substitution of the DDU Subsystem LRUs are as follows:

(1) Floppy Diskette.

(2) FDDU.

(3) FDDC IOSL Card.

(4) DDU Drawer/Chassis.

NOTE: Refer students to System troubleshooting flow chart Tm-11-5805-7900-12-8, para 11-1, pg. 11-5, follow chart through to para 12-8, page 12-35. Explain how to work through these troubleshooting charts. Recapitulate key points. Ask questions to ensure student understanding of material covered.

QUESTIONS: Using the troubleshooting chart para 12-8 what IOSL card controls FDDB?

(ANS: A16A103).

What is the first thing that should be considered when there is a problem in the FDD?
(ANS: The floppy is bad).

How many circuit breakers are on the DFDD?
(ANS: 2).

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5. Removal/Replacement Procedures.

NOTE: Refer students to TM-11-5805-790-12-7.

a. Floppy Disk Drive (FDD) Module.

(1) Set the POWER switch for the FDD to be removed to OFF.
(2) Unfasten the four knurled captive screws holding the FDD in the DDU.

NOTE: Before next step, inform students that the FDD has cables attached to it that can be damaged if the FDD is pulled out swiftly.

(3) Gently slide the FDD forward to the drop position to access the cables on the back of the FDD.
(4) Remove cables by loosening two screws from each connector.
(5) To replace reverse the above steps.

b. Disk Drive Unit (DDU).

(1) Turn off the DFDD circuit breaker.
(2) Remove both FDDs.
(3) Remove the four captive screws holding the DDU to the equipment rack.
(4) Slide the DDU out far enough to access the cables on the back.
(5) Disconnect the cables.
(6) To replace reverse the above steps.

c. IOSL Card.

NOTE: Refer students to TM-11-5805-790-12-7 for the proper removal and replacement procedures. Cards in the CAP/CNTRL nest is ESD sensitive and requires special handling; otherwise, damage may occur.

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6. Storage Device System (SDS).

NOTE: Show Slide 5.

a. Storage Device System features.

(1) High speed.
(2) Random file access.
(3) Mass storage capability.

(a) Two removable Storage Device Units (SDUs).
(b) Each SDU has independent controllers.

b. Operating Environment - Conditions where the SDS will function without degradation.

(1) Pressure/Altitude.
(a) Sea level to 10,000 feet.
(b) In-transit (non-operating) up to 40,000 feet without damage.

(2) Temperature Range.

(a) At -25^{o}F to +130^{o}F, fully functional.
(b) At -50^{o}F, the SDS can safely be powered up.
(c) When powered up at -50^{o}F, there is a 2-hour warm-up period.

1. The SDUs have an internal heater filament.
2. It raises the mass temperature to an operating level.

(d) Non operating range -70^{o}F to 160^{o}F.

(3) Humidity - The system will operate at up to 100% humidity.

(a) At ambient air temperature up to +80°F.
(b) Will operate at low relative humidity of 5% at a temperature of +130°F.

NOTE: Recapitulate key points. Ask questions to ensure student understanding of material covered.

QUESTIONS: What is the fully functional temperature range of the SDD?
(ANS: -25 to 130°F).

What is the warm up period if below -50°F?
(ANS: 2 hrs).

What are the SDU units used for?
(ANS: Storage of control information, message storage, traffic information storage).

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7. Storage Device Units (SDUs).

The SDS consists of two SDUs. The SDU is a removable cartridge, nonvolatile storage device with a minimum formatted capacity of 208 Mbytes. There are 3 SDSs in the message switch that house a total of 6 SDUs: A, B, C, D, E, F and six spares.

a. Characteristics.

(1) Head Locking - Retracts the read/write head to a safe position (park).

(a) Automatic - Head parks when not in use.
(b) Parking prevents damage to disk surface During removal and replacement Storage and transit.
(c) Parking prevents magnetic residue from damaging stored data.

(2) Installation and Removal of SDU.

(a) No tools required.
(b) Only rotational force.
(c) Does not require powering off entire SDS.

b. Performance Characteristics - Minimum formatted capacity of 208 Mbytes.

NOTE: Show Slide 6.

(1) Eight Surfaces.

(a) Four physical disks.
(b) Two sides per disk platter.

(2) One head per surface.
(3) 1368 tracks per surface.
(4) 38 sectors per track; minimum of one spare sector per track to use as replacement for bad sectors.
(5) 512 bytes stored in each sector.
(6) Nominal transfer rate; 400 kb/s.
(7) Limited transfer rate; 100 kb/s to/from SDUC.
(8) Average data seek time of 25 ms.
(9) Error Rate.

(a) Unrecoverable error rate not exceeding 1 in 1012 bits.
(b) Recoverable error rate not exceeding 1 in 1010 bits.

NOTE: Recapitulate key points. Ask questions to ensure student understanding of material covered.

QUESTION: How many SDUs are there in the message switch? (ANS: 6 with 6 spares).

What size drives are the SDUs? (ANS: 208 MBYTES).

What tools are needed to remove the SDUs? (ANS: NONE).

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8. SDS Controls and Indicators.

NOTE: Show Slide 7.

a. J1 - SCSI interface connector (SDU A).

(1) Socket MS27505E 17F 35S type connector.
(2) Connects the SDUC card to the SDU.

b. J2 - SCSI interface connector (SDU B).

(1) Socket MS27505E 17F 35S type connector.
(2) Interfaces to the SDUC card.

c. J3 - Power connector.

(1) Plug MS27656T 13F 4P type connector.
(2) 4-pin connector; pins assigned as follows:

(a) Chassis ground.
(b) +26.5 Vdc.
(c) +26.5 Vdc return.
(c) Spare.

d. Ground Lug (E2) provides a point where chassis ground is connected.

NOTE: Show Slide 8.

e. Power ON/OFF toggle switch controls power applied.
f. POWER indicator, LED indicated power ON.
g. DRA (SDU A).

(1) NOT RDY LED - Indicates the unavailability of SDU A.
(2) BUSY LED - Indicates that SDU A is performing I/O functions.

h. DRB (SDU B).

(1) NOT RDY LED - Indicates the unavailability of SDU B.
(2) BUSY LED - Indicates that SDU B is performing I/O functions.

NOTE: Show Slide 9.

i. SDU Locking Bar.

(1) Operates a micro-switch which activates the NOT RDY Status.
(2) Provides a physical restraint from accidental removal.

(3) Removes power from SDU.

NOTE: Recapitulate key points. Ask questions to ensure student understanding of material covered.

QUESTION: Which LED indicates SDU is performing functions? (ANS: BUSY).

What removes power from just one SDU without removing power from the SDS? (ANS: Locking bar).

What connector applies provides power to the SDS? (ANS: J3).

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9. Storage Device System Functional Block Diagram.

NOTE: Show Slide 10.

a. Each of the six SDUs have their own SDUC interfacing them to the host processor.
b. Host processor communicates to the SDUC.

(1) The CAP selects the IOE bus to be used by the SDUC.
(2) The selected IOE bus connects to the SDUC.
(3) The SDUC will interface the IOE bus to the SCSI bus.
(4) The SCSI bus connects to the SDS; there is a separate SCSI bus for each SDU.

c. Storage Device System Interface

NOTES: Show Slide 11.

(1) The control card within the SDS provides the SCSI bus termination resistors, which gives the signal a current sink and source to cancel noise on the signal line.
(2) SCSI interface signals between the SDUC and the SDU are as follows.

(a) Busy (BSY) - An OR-tied signal that indicates that the bus is being used.

(b) Select (SEL) - A signal used by the SDUC to select the SDU or by the SDU to reselect the SDUC.
(c) Command/Data (C/D).

1. A signal driven by the SDU that indicates whether control or data information is on the data bus.
2. True (active) indicates control.

(d) Input/Output (I/O).

1. A signal driven by the SDU that controls the direction of data movement on the data bus with respect to the SDUC.
2. True (active) indicates input to the SDUC.

(e) Message (MSG) - A signal driven by the SDU during the message phase.
(f) Request (REQ) - A signal driven by the SDU to indicate a request for a REQ/ACK data transfer handshake.
(g) Acknowledge (ACK) - A signal driven by the SDUC to indicate an acknowledgment before a REQ/ACK data transfer handshake.
(h) Attention (ATN) - A signal driven by the SDUC to indicate the attention condition.
(i) Reset (RST) - An OR-tied signal that indicates the reset condition.
(j) Data Bus Parity (DBP) - Set to odd.
(k) Data Bus 8 (DB 7-0) - Eight data-bit signals form a data bus.

1. DB7 is the most significant bit and has the highest priority during the arbitration phase.
2. Bit number, significance, and priority decrease downward to DB0.
3. A data bit is defined as one when the signal value is true, and is defined as zero when the signal value is false.

(3) Blocks of data are transferred over this asynchronous, 8-bit, parity-detected bus one byte at a time (over eight parallel lines).
(4) The SDUC can communicate with the SDU over the SCSI bus with a maximum cable length of 18 feet.
(5) 50-pin "D" type connector.

d. SDS Functions.

NOTE: Show Slide 12.

(1) Maintains the SDU operating environment.
(2) Contains the following assemblies/parts.

(a) J1 - SCSI bus connector for SDU A from the SDUC card.
(b) J2 - SCSI bus connector for SDU B from the SDUC card.
(c) J3 - Power connector 26.5 Vdc.
(d) J4 - SDU A SCSI bus signal path.

1. Cabling from J1 to motherboard connector J4.
2. From connector J4 on the motherboard (foil patterns) to the control board.
3. The SCSI bus termination resistors are located on the control board.

(e) J6 - SDU B SCSI Bus Signal Path.

1. Cabling from J2 to motherboard connector J5.
2. From connector J5 on the motherboard (foil patterns) to the control board.
3. The SCSI bus termination resistors are located on the control board.

(f) J7 - SDU A signals coming from the SCSI bus termination resistors on the control board.
(g) J5 - SDU B signals coming from the SCSI bus termination resistors on the control board.

(h) J8 - Provides heater current to SDU heater filaments and operating voltages to the SDUs.
(i) J9 - Provides heater current to SDU heater filaments and operating voltages to the SDUs. Also operates the microswitch for door A and door B.
(j) J10 - Power supply interface connector.

1. Supplies +26.5 Vdc to the dc/dc converter.
2. Returns operating voltages +5 Vdc and +12 Vdc.

(k) J11 - Power supply interface connector.

1. Supplies +26.5 Vdc to the dc/dc converter.
2. Returns operating voltages +5 Vdc and +12 Vdc to J10 which is used to power the SDUs.

(l) J12 - Provides operating voltages to the front panel indicators (+5v) and the fan (+12 Vdc).
(m) Filter - Blocks Radio Frequency Interference (RFI) entering or exiting the SDS.
(n) TB2 - Interconnection block for dc distribution.
(o) DC/DC converter - Provides all necessary operating voltages to the SDUs.
(p) Control Card - Controls the SDU heater elements and provides SCSI bus termination resistors.
(q) SDU A and SDU B - The nonvolatile mass storage cartridges used by the AN/TYC-39A.
(r) ON/OFF - The front panel power toggle switch.
(s) Fan - Used for SDS ambient cooling.

e. Removal and replacement procedures.

NOTE: Refer to TM-11-5895-1468-34, para 3-6. Go over the removal procedures with the students and instruct the students that this procedure is optional.

f. SDS Maintenance Fault Isolation Routine.

NOTE: 1. Start with the system troubleshooting flow chart in TM 11-5805-790-12-8 para 11-1 page 11-5 then SDS flow chart para 12-9, pg. 12-39. When directed to perform diagnostic routines by the fault isolation procedures, remember that all new or modified maintenance routines, with the exception of DCAP, use the Load Fault Isolation Module (LFIM) routine.

NOTE: Show Slide 13.

(1) At off-line processor enter LFIM for NEXT JOB.
(2) Respond to query for DEVICE ID FOR FDD ILPn. If loading from SDU, enter "N" and respond to "DEVICE ID FOR SDU ILPn" query.
(3) Enter SDU to test A-F.
(4) At the prompt, enter RUN.
(5) A diagnose code of 760000 is interpreted as NO fault detected.
(6) An error diagnose code of 300XXX will indicate that a fault has been detected.

NOTE: Refer students to TM 11-5805-790-12-8, para 12 -9, page 12-40 for Error Diagnose Codes.

(a) Where XXX is a number that corresponds to a particular error.
(b) All error diagnose codes should result in replacement of the SDUC card (IOSL) or the SDU.

NOTE: Recapitulate key points. Ask questions to ensure student understanding of material covered.

QUESTIONS: What type of interface does the SDU have with the controller?
(ANS: SCSI).

What diagnostic program is run on the SDU?
(ANS: DSDU).

What job routine is run to start the diagnostics?
(ANS: LFIM).

What error is 300150?
(ANS: Stop error).

3H

10. Practical Exercise.

NOTE: During this practical exercise, evaluate the students ability to troubleshoot the FDD and SDU.

a. Explanation to students.

(1) This is a two-part practical exercise. During this practical exercise, you will practice performing troubleshooting procedures that will enable you to locate faults within the FDU or SDU.
(2) Part One. Use the AN/TYC-39A; TM 11-5805-790-12 and 34 series manuals; digital multimeter; and Practical Exercise, 150-74G10/G01-LP01-PE to isolate and repair 2 out of 3 faults in FDU or SDU within 30 minutes per fault.
(3) Part Two. You must correctly answer 14 out of 20 written questions pertaining to FDU and SDU fault isolation and repair within 1 hour 30 minutes.
(4) Perform the procedures that are directed and have your instructor evaluate you as you perform each step.
(5) Remember to be extremely cautious as you handle the components of the power group. High voltages are present in this equipment.
(6) When you are finished with the practical exercise, have your instructor grade it for you.
(7) If what you are required to do is not clear, ask your instructor for clarification.

b. Application by students.

(1) Part One. Using the AN/TYC-39A; TM 11-5805-790-12 and 34 series manuals: digital multimeter, and Practical Exercise, 150-74G10/E02-LP05-PE the students will isolate and repair 2 out of 3 faults in the FDU or SDU.
(2) Part Two. The students will answer written questions pertaining to FDU and SDU fault isolation and repair.

c. Evaluation. During Part One of this practical exercise, evaluate each student to ensure they have the ability to use the fault isolation flowcharts to isolate and repair faults in the FDU and SDU within 30 minutes per fault. In Part Two, evaluate each student to ensure they can correctly answer at least 14 out of 20 questions pertaining to FDU and SDU fault isolation and repair within 1 hour.

15 H 55 M

SUMMARY/CONCLUSION:

The SDS and the FDD are vital pieces of equipment to the Message Switch. It is important that you have a working knowledge of how the SDS and FDD operates in order to maintain it. You will be given the opportunity to run the diagnostics during the practical exercise.

16 H

END

This document supports Task Number 113-603-3222 and 113-603-3226.

PRACTICAL EXERCISE ANSWER KEY

1. a. DFDD Functions

   (1) Perform message switch program load.
   (2) Apply/update database on the message switch program load device.
   (3) Read/write database files.

2. There are two SCSI boards that support the DDU.
3. The Min and Max Input voltages are 21Vdc and 32Vdc.
4. Data Transfer Rate, SCSI Data transfer rate is 1.5 Mbytes per second and Media Data transfer rate is 500 kb/s minimum.
5. The yellow light indicates that the drive is currently in use.
6. Pressure Altitude

   a. Operational range is sea level to 10,000 feet.
   b. Non-operational range is sea level to 40,000 feet with a rate of altitude not exceeding 2500 feet per minute.

7. The recording density is 17,434 Bits Per Inch (BPI) max.
8. TM 11-5805-790-12-7 para 10-19 covers Removal & replace procedures.
9. CB 2 Applies power to drive B.
10. J3 and J4 supplies power to the SDS.
11. There are three SDS in the AN/TYC-39A.
12. Error Rate

   (a) Unrecoverable error rate not exceeding 1 in 1012 bits
   (b) Recoverable error rate not exceeding 1 in 1010 bits

13. SDU Locking Bar

   a. Operates a micro-switch which activates the NOT RDY status
   b. Provides a physical restraint from accidental removal
   c. Removes power from SDU

14. The purpose of the SDS is to provide high-speed, random file access, and mass storage capability. The SDS houses two SDU which interfaces with the processor via a SCSI board.
15. Eight heads one for each surface.
16. J10 - Power supply interface connector

    a. Supplies +26.5 Vdc to the dc/dc converter
    b. Returns operating voltages +5 Vdc and +12 Vdc

17. LFIM is ran from the Off-line processor, LFIM is a off line command and requires full use of the processor.
18. 760000.
19. 300072 code indicates ITR status error litton read SCSI WRT replace IOSL card, then SDU.
20. J9 - Provides heater current to SDU heater filaments and operating voltages to the SDUs. Also operates the microswitch for door A and door B.

US ARMY SIGNAL CENTER AND FORT GORDON
Fort Gordon, Georgia 30905-5180

LESSON PLAN

TITLE: AN/TYC-39A L-3050V Processor and CAP/CONTROLLER Nest

LEARNING OBJECTIVE:

Action: The student will describe the L-3050V and CAP functions and will perform L-3050V and CAP maintenance, which will include removal and replacement procedures.

Condition: The student is given the Student Guide, practical exercise 150-74G10/G01-LP02, TM-11-5805-790-12-1, TM-11-5805-790-12-7, TM-11-5805-790-2-8, TM-11-5805-790-34, and TM-11-5895-1517-34.

Standard: The student has met the learning objective when he/she can isolate 2 out of 3 malfunctions in 30 minutes per fault and correctly answer 14 out of 20 questions on the Practical Exercise.

SAFETY CONSIDERATIONS: **DANGER.** High voltages are present in this equipment. Remove all jewelry before working on the equipment.

RISK ASSESSMENT: A risk assessment has been conducted on this unit of instruction and the risk level is deemed to be: LOW RISK.

RESOURCE NEEDS/ REFERENCES: AN/TYC-39A, Overhead Projector, Transparencies 1-25, Student Guide, Chalkboard TM-11-5805-790-12-1, TM-11-5805-790-12-7, TM-11-5805-790-12-8, TM-11-5805-790-34 series, and TM-11-5895-1517-34.

APPROVAL DATE: DEC 11,1997
DEVELOPER: SSG Shank
DIV. CHIEF: Jack P. Rondon

METHOD OF
INSTRUCTION: Conference and Practical Exercise

TIME: 18.0 Hours

NOTES:

1. Ensure that the classroom is available and properly set up and that all equipment and training resources are available and in working order.
2. Ensure that enough technical manuals and Student Guides are available and account for all transparencies.
3. Before the end of class, evaluate students on their ability to perform the learning objective.
4. State all safety notes as they appear throughout the lesson plan.
5. State ESD warning.

ELAPSED
TIME:

INTRODUCTION:

NOTE: Show Slide (1)

1. To successfully operate the AN/TYC-39A, you need a good working knowledge of the L-3050V processor. In this lesson, we will study the functions and maintenance procedures of both the L-3050V processor and the CAP/CONTROLLER nest.

5M

BODY:

1. AN/TYC-39A L-3050V Processor.

NOTE: Show Slide (2)

a. There are two Central Processors (CP) in the central processor group. One is for the on-line system and the other is a redundant automatic backup.
b. There are only five printed circuit cards in each L-3050V.

NOTE: Show Slide (3)

(1) A1 QIOE (Quad Input/Output Expander) interfaces up to 32 peripherals.
(2) A2 CPU (Central Processor Unit) consists of:

(a) CPU, which handles the switching for the message switch.
(b) Input/Output Controller (IOC), which controls the IOE and the Solid State Memory (SSM).

(3) A3 is spare.
(4) A4 to A7 are used for the solid-state memory cards.

(a) Memory Size is 8M, 12M, or 16M.

(5) A8 consists of the termination card.

(a) The termination card terminates each signal with a 120-ohm resistor to +5 volts.
(b) All signals are twisted-pair.
(c) The logic levels for device communication signal is as follows (measured at any point on the line).

1. A logic 1 is a pulse having a pulse width within the range 180 nanoseconds ±30 nsec.
2. The amplitude is within the range of 0.75 ±0.75 volts dc.
3. A logic 0 is a signal with an amplitude within the range 4.35 volts ±1.15 volts dc.

c. Power Consumption.

(1) 152W.

d. Reliability.

(1) Mean Time Between Failures (MTBF) is approximately 15,000 hours.

NOTE: Recapitulate key points. Ask questions to ensure student understanding of material covered.

30 M

2. L-3050V Physical/Functional Description.

NOTE: Show Slide (4)

a. L-3050V Front Panel Controls and Indicators.

(1) PROGRAM TEST.

(a) Two octal thumbwheel switches.
(b) Its function is to specify the device address for program load or setting to select a DCAP M&FI routine.

(2) DIAGNOSE STATUS Display.

(a) A 6-digit octal LED display.

(b) Its function is to indicate diagnose code on faults displayed by BITE or software.

(3) RESTART.

(a) Momentary action pushbutton switch.
(b) When activated, causes a master reset to CPU and I/O devices and an interrupt to the program.

b. L-3050V Front Panel (Back view).

NOTE: Show Slide (5)

(1) S1: Restart Switch.
(2) S2: Program Test Switch.
(3) A1: Diagnose Status Display.
(4) J1: Interface to the L-3050V Processor.

c. L-3050V Processor Rear View (Proc 1).

NOTE: Show Slide (6)

(1) J1 is not used.
(2) J2 Processor-to-Processor interface is installed but not used.
(3) J3 IOE 1 interface uses cable W447 and connects to the controller nest J5.
(4) J4 is spare and is not used.
(5) J5 IOE 3 interface uses cable W205 and connects to the DLC/ILI nest J23.
(6) J6 Front Panel Interface (FPI) interfaces to the front panel assembly.
(7) J7 IOE 7 interface is not used.
(8) J8 IOE 4 interface uses cable W204 and connects to the controller nest J6.

d. L-3050V Processor Rear View (Proc 2).

(1) J1 is not used.
(2) J2 Processor-to-Processor interface is not used.
(3) J3 IOE 1 interface uses cable W447 and connects to the controller nest J5.
(4) J4 is spare not used.
(5) J5 IOE 3 interface uses cable W206 and connects to the DLC/ILI nest J21.
(6) J6 Front Panel Interface (FPI) interfaces to the front panel assembly.
(7) J7 IOE 7 interface is not used.
(8) J8 IOE 4 interface uses cable W204 and connects to the controller nest J6.

NOTE: Recapitulate key points. Ask questions to ensure student understanding of material covered.

45 M

3. L-3050V Processor Functional Block Diagram.

NOTE: Show Slide (7)

a. Central Processor Unit (CPU).

(1) Runs the Central Processing Group Control and Operational Program (CPGCOP).
(2) Provides arithmetic and control functions using five major blocks.

(a) Instruction Controller - This block controls the sequence of operations within the CPU.
(b) Program Level Control - This block updates and checks the priority queue to determine that the highest priority program available to run is actually running.
(c) Arithmetic Section - This block contains a high-speed, 32-bit parallel adder, as well as field extraction and alignment logic, which makes possible the various field operations of the processor.
(d) Memory Interface Controller - This block contains memory address and memory data registers.
(e) Process Registers - This block contains sixteen 32-bit registers used as accumulators, index registers, or to hold instructions during the execution of program loops.

b. Front Panel Interface - Allows the CPU to communicate with the front panel.
c. Solid-state memory (RAM) stores the database.

(1) The SSM provides random access high-speed memory for use with the computer and has the following functional characteristics:

(a) Accepts and responds to control signals from the bus master.
(b) Accepts and stores data from the bus masters.
(c) Generates response and transmits data to the bus masters.

(2) Each SSM circuit card contains four megabytes of memory.
(3) Normal configuration is two circuit cards (eight megabytes).
(4) Expandable in increments of four megabytes up to 16 megabytes.
(5) The SSM bus interface provides an arbitration capability for four bus masters.

(a) The CPU and the IOC are identified as bus masters.
(b) The L-3050V provides expansion for two additional (spare) bus masters.

(6) The SSM provides two modes of operation.

(a) Read Mode - The memory reads the data stored in the specified address and transmits the data to the bus masters.
(b) Write Mode - The data transmitted from the bus masters is stored in the specified memory address.

(7) Addressing - A 25-bit address is used for addressing up to 16,777,216 words of memory.
(8) The bit error rate for the SSM is less than 1x10 to -12.

NOTE: Show Slide (8)

(9) The SSM has a word length of 33 bits.

(a) 32 data bits.
(b) One parity bit.

NOTE: Take time to explain the SSM word length-to-byte relationship.

(10) One 33-bit word equals four bytes. (Parity bit has been excluded).
(11) One megaword equals 1,048,576 words or 4,194,304 bytes or 33,554,432 bits per SSM circuit card.
(12) The L-3050V has the capability to populate up to four SSM modules, providing a total memory storage capacity of four megawords or 16 megabytes.
(13) In the AN/TYC-39A, we are using only two SSM modules, which gives us one of the following.

(a) Two megawords at 33 bits per word.
(b) Eight megabytes at eight bits per BYTE.

d. Input/Output Unit (IOU) - Controls the interface between the CPU and its peripherals and controllers.

NOTE: Reshow Slide (7)

(1) Consists of one Input/Output Controller (IOC) and up to seven Input/Output Exchangers (IOEs).
(2) IOC.

(a) Multiplexes data between the memory and peripheral devices.
(b) Receives instructions from the CPU regarding input/output handling requirements.

1. Read.
2. Write.
3. Status.
4. Change state.

(3) IOE.

NOTE: Show Slide (9)

(a) Provides control and data paths for the CPU.
(b) Each IOE can service up to eight peripheral devices.
(c) In the AN/TYC-39A, only three IOEs are used.

1. One.
2. Three.
3. Four.

(d) Allows the on-line processor to update the database of the other processor, if the other is in standby.
(e) IOEs are used for short cable lengths.
(f) There is no IOX for cables longer than 50 feet anymore.
(g) The transfer of information is over 20 twisted-pair lines.

(h) Information lines, nine bi-directional bused lines are used for the purpose of transmitting information between the IOC and devices.

1. Data Signal.

a. Eight of the information lines transmit the data byte.

b. The ninth line, parity (P), is pulsed to create odd parity across the nine information lines during the data transmission phase of communication.

2. Address Selection.

a. The eight information lines are used in conjunction with the enable line or command line to specify a peripheral device address.
b. The ninth information line (P) is not pulsed during the address selection phase.

3. Device Control.

a. After an address selection phase using the command line, the eight information lines are used to specify an operation to be performed by the device.
b. The ninth information line (P) is pulsed to create odd parity across the nine information lines.

(i) Indicator Line - Used by the device to acknowledge receipt of a CPU command and to initiate a device interrupt.
(j) Enable Line.

1. The enable line is used by the IOC in conjunction with the information lines to perform device address selection.
2. The transfer of information that follows address selection using the enable line is one of the following.

    a. A data transfer between the IOC and the device.
    b. A data transfer between the device and the IOC.
    c. A device interrupt.

(k) Command Line.

1. The command line is used by the IOC, in conjunction with the information lines, to perform device address selection.
2. When the command signal appears, the information byte that follows the address selection phase is one of the encoded command operations.
3. Further information flow depends on the command issued.
4. The command line is also used, in conjunction with the enable line, to signify a master reset to the device.

(l) Request Lines.

1. Each channel contains eight request lines (0 - 7).
2. One of the request lines is assigned to each functional device connected to the channel.
3. The IOC provides a fixed relationship between the request line number and the three least significant bits of the device address for each device.
4. The device uses the request line to request service from the IOC.

(4) The processor has three major IOE channels for I/O transfers.
(5) These three major IOE channels each have eight minor addresses, for a total of 24 channels.
(6) These addresses are given prioritized service from the input/output controller of the processor.

(a) Channel address 10 being the highest priority.
(b) Channel address 47 being the lowest priority.

1. The first number indicates the major channel.
2. The second number indicates the minor channel.

(7) Major channels used in the AN/TYC-39A are 1, 3, and 4.

(a) Each of these major channels has a separate electrical interface capable of communicating up to 50 feet away.
(b) The IOE with the major device address of 1 (IOE 1), of the on-line CPU controls the following controllers.

NOTE: Show Slide (10)

Refer students to IS C1-2, IOE Bus Physical Interface Diagrams.

1. Channel 10 is the address of the Floppy Disk Drive Controller-A (FDDC-A).
2. Channel 11 is the address of the Floppy Disk Drive Controller-B (FDDC-B).
3. Channel 12 is the address of the Line Printer Controller-A (LPC-A).
4. Channel 13 is the address of the Line Printer Controller-B (LPC-B).

5. Channel 14 is the address of the Video Display Terminal Controller-A (VDTC-A).
6. Channel 15 is the address of the Video Display Terminal Controller-B (VDTC-B).
7. Channel 16 is the address of the Processor-to-Processor Interface (PPI). (This is not used in the message switch.).
8. Channel 17 is the address of the Video Display Terminal Controller-C (VDTC-C).

(c) The IOE with the major device address of 3 (IOE 3) controls the CPU's interface with the following controllers.

NOTE: Show Slide (11)

1. Channel 30 is a spare.
2. Channel 31 is a spare.
3. Channel 32 is the address of the SBC XMIT controller.
4. Channel 33 is the address of the SBC RCV controller.
5. Channel 34 is the address of the MDL-A controller.
6. Channel 35 is the address of the MDL-B controller.
7. Channel 36 is reserved for COMSEC.
8. Channel 37 is reserved for COMSEC.

(d) The IOE with the major device address of 4 (IOE 4) controls the CPU's interface with the following controllers.

NOTE: Show Slide (12)

1. Channel 40 is the address of the CAP-A controller.
2. Channel 41 is a spare.
3. Channel 42 is the address of the SDUC-A controller.
4. Channel 43 is the address of the SDUC-B controller.

5. Channel 44 is the address of the SDUC-C controller.
6. Channel 45 is the address of the SDUC-D controller.
7. Channel 46 is the address of the SDUC-E controller.
8. Channel 47 is the address of the SDUC-F controller.

NOTE: Recapitulate key points. Ask questions to ensure student understanding of material covered.

1 H 30 M

4. Evaluating Diagnose Codes - Diagnose codes are displayed on the front panel.

NOTE: Reshow Slide (4)

a. Test passed is indicated by 000000.
b. If any test fails, a code is displayed here.
c. If a fail code is displayed refer to the processor fault isolation flow chart in TM 11-5805-790-12-8 para 12-6, page 12-10.

NOTE:
1. Refer the students to TM 11-5805-790-12 8 para 12-3, page 12-4, Diagnose Status Error Code Listings.
2. Recapitulate key points. Ask questions to ensure student understanding of material covered.

1 H 45 M

5. Removal and Replacement Procedures.

NOTE: Refer students to the TM 11-5805-790-12-7, para 10-7, page 10-10 and 5 for procedures to remove the individual parts within the front panel.

a. Front Panel.

(1) When the processor front panel fails to perform as expected, there are a few replaceable components on the front panel that should be checked.

(a) Program load switch (S1).
(b) Program test switches (S2).
(c) Diagnose status LEDs (A1).
(d) Front panel interface cable (J1).

(2) In order to replace any of these components, it is necessary to first remove the front panel from the L-3050V nest.

(a) Step 1: While holding the front panel in place, loosen the 12 retaining screws.
(b) Step 2: Carefully draw the front panel out of the rack and expose the cable connector.
(c) Step 3: Loosen the two screws securing the cable connector to J1.
(d) Step 4: Remove the cable connector and remove the front panel.

b. L-3050V Processor Card Cage Removal and Replacement.

NOTE: 1. Refer students to TM 11-5805-790-12-7, para 10-8, page 10-14 to remove the L-3050V card cage and circuit cards.
2. Remind the students to take ESD precautions when handling all circuit cards.
3. Read the following warning to your students.

WARNING: To avoid personal injury and possible equipment damage, two persons are needed to remove card cage from shelter.

NOTE: Recapitulate key points. Ask questions to ensure student understanding of material covered.

6. AN/TYC-39A CAP/Controller Nest.

a. CAP/Controller Nest - Provides control and interfaces between the Message Processors (MPs) and the message switch equipment.

NOTE: Show Slide (13)

Refer students to TM 11-5805-790-12-7, para 10-11. page 10-25.

b. The CAP/Controller nest is a 41-slot nest, consisting of the following.

(1) Configuration and Alarm Panel (CAP).

(a) One CAPA card, found in slot 13.
(b) Two CAPB cards, found in slots 14 and 15.

NOTE: 1. Show Slide (14)

Refer students to TM 11-5805-790-12-6, para 7-24. page 7-50.

(c) One CAPC card is located outside the CAP/Controller nest in the ILIP nest in row 3 slot 40.

NOTE: Reshow Slide (13)

(d) All four cards together perform configuration control for the peripheral devices, DLC, ILI, MTG, ICU and SBC.
(e) The CAP also performs status reporting for the two MPs of the:

1. Shelter Alarms.
2. DCS.
3. MTG.
4. TDIGM.

(2) Two Input/Output SCSI Link (IOSL) Floppy Disk Drive Controllers.

(a) FDDC-A is found in slot 2.
(b) FDDC-B is found in slot 3.
(c) FDDCs A and B provide the interface between an FDD and one of the MPs IOE channels.

(3) Two Line Printer Controllers.

(a) LPC-A is found in slot 4.

(b) LPC-B is found in slot 5.
(c) LPCs A and B provide the interface between a line printer and one of the MPs IOE channels.

(4) Three VDT/Teletype Controllers (VTTYC Cards).

(a) VTTYC-A is found in slot 6.
(b) VTTYC-B is found in slot 7.
(c) VTTYC-C is found in slot 8.
(d) VTTYC's A, B, and C provide the interface between a video display terminal and one of the MPs IOE channels.

(5) Two Resistor Termination Cards (RST-1 Cards).

(a) RST-1 - Proc 1 - Found in slot 10 and used for resistor terminations for major channels 1 and 4.
(b) RST-1 - Proc 2 - Found in slot 11 and used for resistor terminations for major channels 1 and 4.

(6) Six SDUC Input/Output SCSI Link (IOSL) - Storage Device Unit Controllers.

(a) There is one controller per storage device unit.
(b) SDUC-A is found in slot 25.
(c) SDUC-B is found in slot 26.
(d) SDUC-C is found in slot 27.
(e) SDUC-D is found in slot 28.
(f) SDUC-E is found in slot 29.
(g) SDUC-F is found in slot 30.
(h) All SDUCs provide the interface between a storage device unit and one of the MPs IOE channels.

c. The CAP/Controller nest is powered by the redundant power processors (PS14 and PS15) utilizing the +/- 5 volts and +/- 15 volts.

NOTE: Recapitulate key points. Ask questions to ensure student understanding of material covered.

QUESTIONS: What card is found in card slot A16A125?
(ANS: SDU-A).

What rack and slot number is the controller for FDD-B?
(ANS: A16A103).

What rack and slot number is the CAPC card found in?
(ANS: A25A340).

What are RST-1 cards used for?
(ANS: For resistor terminations for major channels 1 and 4).

For which cards must the power be turned off before removal?
(ANS: ISOL).

2 H

NOTE: Show Slide (15)

7. Control and Alarm Panel.

a. The CAP is a man-machine interface extension of the control and alarm circuitry located in the controller nest.
b. CAP Controls and Indicators.

(1) PROGRAM LOAD.

(a) PROC 1 Pushbutton - Used to start processor's bootstrap loading (processor 1).
(b) PROC 2 Pushbutton - Used to start processor's bootstrap loading (processor 2).

(2) PROCESSOR STATUS.

(a) ON LINE Lamp (green) - Lights when processor is on line (processor 1 or 2).

(b) STANDBY Lamp (yellow) - Lights when processor is in standby mode and capable of assuming on-line functions (processor 1 or 2).
(c) OFF LINE Lamp (red) - Processor 1 or 2.

1. Lights steady to indicate that processor is off line and not executing the standby routine.
2. Flashes to indicate a fault in the processor.

(3) PERIPHERALS.

(a) PROC 1/PROC 2 Switch - Selects the processor to control the DCS channels for the following peripherals:

1. FDDC.
2. VDTC.
3. LPC.
4. SDUC.

(b) This switch has no control when either processor is on-line.
(c) INITIATE Pushbutton - Assigns the peripherals to the processor selected by the PROC 1/PROC 2 Switch.

(4) SUMMARY FAULT/LAMP TEST.

(a) SUMMARY FAULT Indicator - Lights when a fault is detected; remains lit until reset.
(b) Audible Alarm - Sounds when a fault is detected.
(c) Alarm TEST/RESET pushbutton.

1. If pressed with the alarm sounding, shuts off the alarm and resets the alarm circuitry.
2. If pressed without an alarm, turns on the alarm for testing.

(d) LAMP TEST pushbutton - When pressed, all indicators on the CAP light.

c. CAP Functional Block Diagram.

NOTE: Show Slide (16)

(1) Each processor has its own IOE interface because:

(a) The CAP must be able to accept commands from both processors at the same time.
(b) The interfaces are identical for both processors.

(2) The CAPA has two keep-alive monitors which is the mechanism of detecting switchover conditions.

(a) If a switchover condition occurs, the keep-alive monitor triggers a processor switchover by interrupting the alternate processor.
(b) The CAPA must receive a keep-alive code from the on-line processor every 100 milliseconds or less, or a switchover condition will occur. If the alternate processor is in standby, a switchover will take place.

(3) The CAPA processes three types of commands received from both processors.

(a) ITR - Input to Register (one for each processor).

1. The ITR command is used as the mechanism for the processor to request status collected by the CAP.
2. Status is collected and stored by the CAP in the ITR registers.
3. An ITR pointer is used to sequence the transfer of status words to the requesting processor.

(b) OFR - Output From Register.

1. The OFR command is used as the mechanism for the processor to issue configuration commands to all DCS channels, the MTG, and TDIGM interfaces.
2. Only when the OFR command does not contain a keep-alive code will it perform DCS switching.
3. The DCS command is used to switch the following devices to the on-line or off-line processor:

    a. VDTC.
    b. LPC.
    c. SDUC.
    d. ILI.
    e. SBC.
    f. DLC.
    g. FDDC.
    h. MTG.
    i. ICU.

4. The OFR command instructs the CAP to perform one of the following actions.

    a. Connect to processor 1.
    b. Connect to processor 2.
    c. Connect to neither processor.
    d. Reset.

(c) DEV – Device.

1. The DEV command is used as the mechanism for the processor to control the operation of the CAP.
2. The CAP accepts the following DEV commands from both processors.

    a. DEV CAP CONTROL - Switches CAP control capability to the processor issuing the command. This command does not cause any DCS state changes.

b. DEV IOE RESET - Performs a reset of IOE-related circuits on the CAP.

c. DEV LOOP TEST - Transfers the next OFR word from the processor to the test word register of the CAP. Then transmits the contents of the test word register upon the next ITR command from the processor. After the ITR transfer, the CAP exits this loop test mode.

d. DEV ON-LINE - Turns on the ON-LINE lamp. The CAP responds to this command only from the controlling processor and only when the CAP acknowledges that the controlling processor is in the standby state.

e. DEV RESET - Places the CAP in the reset state.

f. DEV SOUND ALARM - Operates the CAP audible alarm.

g. DEV STOP - Disables the CAP-to-processor interrupt capability for the processor issuing the command.

h. DEV TRANSMIT ITR WORD x - This is a class of commands which allows the processor to redirect the sequence of ITR word transfer.

i. DEV WAKEUP - Enables the CAP-to-processor interrupt capability for the processor issuing the command.

(4) Fault Detector and Device Interrupt.

(a) The CAP maintains two independent processor fault detection and interrupt devices.

(b) The fault detection provides visual and audible indications of major shelter alarms while also sending status to the processor.

(c) The following are the major shelter alarms that are reported.

1. High Temperature.
2. On-Battery.
3. Power Processor Failure.
4. +24 Volt dc Power Supply Failure.
5. Loss of Air Flow.
6. Shelter Door Open.

(d) The visual fault indicator (SUMMARY FAULT) provides both steady and flashing modes.

1. Flashing indicates an unacknowledged alarm.
2. Steady indicates an acknowledged alarm.
3. Acknowledgment is accomplished using the shelter alarm TEST/RESET switch.
4. The flashing indicator will remain flashing until acknowledged by the operator, even if the alarm condition has disappeared.

(e) The audible fault indicator indicates an unacknowledged alarm for all of the shelter alarms and for loss of keep-alive signal to the off-line processor.

1. Acknowledgment is accomplished using the shelter alarm TEST/RESET switch.
2. The audible indicator will remain sounding until acknowledged by the operator, even if the alarm condition has disappeared.

(5) CAP Front Panel.

(a) The CAP front panel provides the necessary controls and status to the message switch operator.
(b) The CAP front panel provides limited controls if the CAP-to-processor interface should fail during message switch operation.
(c) The CAP front panel interface is provided by the CAPA circuit card.

(6) Configuration Interfaces are provided by the CAPB and CAPC circuit cards and consist of the following:

(a) Controllers.
(b) DLCs.
(c) ILIs.
(d) MTGs.
(e) ICUs.
(f) SBCs.

(7) Serial Interfaces are provided by the CAPA circuit card and consist of the following:

(a) TDIGM.
(b) MTG.

d. CAP Interfaces.

NOTE: Show Slide (17)

(1) CAP A.

(a) IOE Bus - to/from MP.
(b) Serial Bus (differential) - to/from MTGs and TDIGMs.
(c) Shelter Alarms.

(2) CAP B.

(a) To/from MTGs.
(b) To/from SBCs.
(c) To/from Peripheral Controls.

1. FDDCs.
2. VDTCs.

3. LPCs.
4. SDUCs.

(3) CAP C

(a) To/from ICUs.
(b) To/from ILIs.
(c) To/from DLCs.

NOTE: Refer students to TM 11-5805-790-34-3, Figure 6-1 (Interconnect Diagram).

e. CAP A Interface.

NOTE: Show SLIDE (18)

(1) Differential Bus.

NOTE:
1. Refer students to TM 11-5805-790-12-1 paragraph 1-48 pages 1-124,1-125 and point out differential bus connections.
2. Differential Bus Interface, and discuss.
3. IOE Bus interface.
4. CAPA to CAP Panel Interface, and discuss.
5. CAP Panel Program Load Switch Interface, and discuss.
6. Refer students to TM 11-8505-790-12-1 paragraph 1-50 page 1-129, CAPA Shelter Alarm Interface, and discuss.

f. CAP B Interface.

NOTE: Show Transparencies (19) and (20)

(1) One CAPB card can handle:

(a) Eight single-ended controllers.
(b) Two differential DCS controllers.
(c) Two multipurpose (single-ended or differential) DCS controllers.

(2) Single-ended DCS controller consists of a CAPB card interfacing to the following.

(a) Line Printer Controller (LPC).

(b) Video Display Terminal Controller (VDTC).
(c) Floppy Disk Drive Controller (FDDC).
(d) Storage Device Unit Controller (SDUC).
(e) Channels 1 through 8 use the CAPB card in slot 14, and channels 17 through 24 use the CAPB card in slot 15.

(3) Differential-ended DCS controller consists of CAPB card interfacing to the following.

(a) Signaling Buffer Controller (SBC).
(b) Master Timing Generator (MTG).
(c) Channels 9, 10, and 26 use the CAPB card in slot 14, and channels 10, 25, and 26 use the CAPB in card slot 15.

(4) The multipurpose DCS controller can be:

(a) Single-ended interface.
(b) Differential interfaces.

(5) The difference between single-ended and differential-ended is:

(a) Single-ended uses five lines and interfaces within the same nest.
(b) Differential-ended uses 10 lines to make up for the signal lost in distance and interfaces outside the nest.

(6) The following are the channel numbers and peripherals on which the CAPB cards control the DCS.

(a) FDD-A = Channel #1.
(b) FDD-B = Channel #17.
(c) VTTYC-A = Channel #2.
(d) VTTYC-B = Channel #18.
(e) VDC-C = Channel #3.
(f) LPC-A = Channel #4.
(g) LPC-B = Channel #19.
(h) SDUC-A = Channel #5.
(i) SDUC-B = Channel #20.
(j) SDUC-C = Channel #6.
(k) SDUC-D = Channel #21.

(l) SDUC-E = Channel #7.
(m) SDUC-F = Channel #22.
(n) SBC-A = Channel #9.
(o) SBC-B = Channel #25.
(p) MTG-A = Channel #10.
(q) MTG-B = Channel #26.

(7) Pin 105 is the card select for the CAPB cards.

(a) If pin 105 is low, then that card is the first (slot 114) CAPB card. In slot 114, pin 105 is tied to pin 111 (GND).
(b) If pin 105 is high, then that card is the second (slot 115) CAPB card. In slot 115, pin 105 is not tied to pin 111 (GND).

g. CAP C Interface.

NOTE: Show Slide (21)

(1) The CAP C card provides single-ended interfaces to/from 13 ILIs, 2 MDL cards, and the ICUs. It provides one differential select line to each ICU.

(a) Select is used to connect the ILI, MDL, or an ICU to a particular DLC/processor.
(b) Reset is used to reset an ILI or MDL card.
(c) Status is used to indicate which DLC/processor is selected.

(2) The CAP interface consists of RS-422 differential drivers and receivers.

(a) The CAP C card receives select and reset information from the CAP A.
(b) The CAP C card transmits status to the CAP A.

NOTE: Recapitulate key points. Ask questions to ensure student understanding of material covered.

QUESTIONS: How many single ended channels can one CAPB handle?
(ANS: 8).

What is the single ended controller channel number for the VTTYC-A?
(ANS: Channel 2).

Which CAP card interfaces the IOE-bus to and from the message processor?
(ANS: CAPA).

What pin is the card select for the CAPB cards?
(ANS: 105).

3 H 10 M

8. Video Display Terminal Controller (VDTC).

NOTE: 1. Show Slide (22)

a. Item Definition - The VDTC provides conversion of processor input and output signals and formats to that required to operate a visual display terminal.
b. Item Description - The VDTC includes a Dual-Channel Switch (DCS) and provides the means for the following transfers of information.

(1) Transfer of VDT-generated data and commands to either of two processors.
(2) Transfer of processor-generated data and commands to the VDT.
(3) Transfer of VDT screen contents to either of two processors.
(4) Transfer of processor action notifications to the VDT for display.

c. The lines and signals of the IOE channel from the processor are as follows.

(1) Information Lines - Nine bi-directional bussed lines (8 informational and 1 parity) are used for the purpose of transmitting information between the processor and the controllers.

(2) The nine lines have the following functional purposes.

(a) Data Signals.

1. Eight of the information lines are used to transmit the data byte.
2. The ninth line, parity, is pulsed to create odd parity across the nine information lines during the data transmission phase of communication.

(b) Address Selection.

1. The eight information lines are used in conjunction with the enable line or command line to specify a peripheral device address.
2. The ninth information line (P) is not pulsed during the address selection phase.

(c) Device Control.

1. After an address selection phase using the command line, the eight information lines are used to specify operations to be performed by the device.
2. The ninth information line (P) is pulsed to create odd parity across the nine information lines.

(3) Indicator Lines - The indicator line is used by the device to acknowledge receipt of a processor command and to initiate a device interrupt.

(4) Request Lines - Each channel has eight request lines.

(a) One of the request lines is assigned to each controller connected to the channel.

(b) The processor provides a fixed relationship between the request line number and the three least significant bits of the device address for each device.
(c) The device uses the request line to request service from the processor.

(5) Enable Line - The enable line is used by the processor, in conjunction with the information lines, to perform device address selection.

(a) The transfer of information that follows address selection using the enable line is one of the following.

1. Data transfer between the processor and the device.
2. Data transfer between the device and the processor.
3. Device interrupt.

(b) The enable line is also used in conjunction with the command line to signify a master reset to the device controller.

(6) Command Line - The command line is used by the processor in conjunction with the information lines to perform device address selection.

(a) When the command signal appears, the information byte that follows the address selection phase is an encoded command operation.
(b) Further information flow depends on the command issued.
(c) The command line is also used in conjunction with the enable line to signify a master reset to the device.

d. CAP-to-VDTC Interface - The VDTC interfaces with the Control and Alarm Panel (CAP). The CAP signals have the following functions.

(1) CAP Master Reset: The VDTC is reset to its inactive state and sends a RESET signal to the VDT.
(2) Select 1: The VDTC/DCS logic connects the VDTC to processor 1.
(3) Select 2: The VDTC/DCS logic connects the VDTC to processor 2.
(4) Status 1: The VDTC/DCS logic indicates if the VDTC is connected to processor 1.
(5) Status 2: The VDTC/DCS logic indicates if the VDTC is connected to processor 2.

e. VDTC-to-VDT Interface - The VDTC interfaces with the VDT.

(1) The VDTC-to-VDT interface is a serial asynchronous data and control path with transmit and receive lines.
(2) The interface circuit used to interface the VDTC and VDT uses an EIA-RS-422-C balanced circuit.
(3) The VDTC-to-VDT uses a 4-wire set.

(a) Two wires are used to receive data.
(b) Two wires are used to transmit data.

(4) Data control is implemented by using in-band XON and XOFF characters.
(5) The signal interface between the VDTC and VDT are described as:

(a) Transmit Data - One line for transmitting ASCII coded data from the VDTC to the VDT.
(b) Receive Data - One line for the VDTC to receive ASCII coded data from the VDT.

(6) The VDTC meets the requirements with a maximum cable length of 50 feet from the visual display terminal.

f. The VDTC provides a baud rate of 19.2K.
g. CAP, IOE/VDTC Signal Levels - The VDTC accepts line levels of standard TTL logic.

(1) +3.3 to +5.1 volts as logic one.
(2) 0 to +1.5 volts as logic zero.

h. VDT Interface Control.

(1) The VDTC provides timed logical sequences to perform input and output processes with the VDT.
(2) Data is exchanged using ASCII code and a set of escape character sequences.
(3) Data transmission between the VDTC and the VDT is accomplished using a 4-wire full-duplex circuit.
(4) VDTC-to-VDT Data Format.

(a) Data is transmitted to the VDT using text strings framed by Start Transmission (STX) and End Transmission (ETX) control characters.
(b) Buffer control commands (XON and XOFF) are inserted into the data stream during transmission when required.

NOTE: Refer to TM 11-5805-790-12-1, para 1-45, page 1-114 IOU interface channel assignments.

i. IOE Interface Control.

(1) There are a total of three VDTC cards in the controller nest.
(2) The IOE address for the three VDTC are:

(a) Major channel 1 and minor channel 4 for VDTC-A.
(b) Major channel 1 and minor channel 5 for VDTC-B.
(c) Major channel 1 and minor channel 7 for VDTC-C.

(3) The VDTC contains a dual-channel switch to allow one of two processors to be connected to it via their respective IOE busses.

(a) The control logic connects the VDTC to either processor, but never to both simultaneously.

(b) If neither processor is selected on-line, the VDTC is off-line to both and will neither send nor receive signals from the processors.
(c) The DCS is controlled by signals supplied from the Control and Alarm Panel (CAP).

j. The VDTC uses the following voltages.

(1) +5 volts.
(2) -5 volts.
(3) -15 volts.

NOTE: Refer to TM 11-5805-790-34-3, Fig 6-1, pg. 6-2.

k. Cable Interface.

(1) CAP/Controller nest to VDT-A uses cable W210 P5.
(2) CAP/Controller nest to VDT-B uses cable W210 P4.
(3) CAP/Controller nest to VDT-C uses cable W210 P6.

NOTE: Recapitulate key points. Ask questions to ensure student understanding of material covered.

QUESTIONS: What cable connects the CAP controller nest to VDT-B?
(ANS: W210 P5).

What is the IOE address for VDT-C?
(ANS: Major channel=1, Minor channel=7 or 17).

What is the baud rate of the VDTC?
(ANS: 19.2K).

3 H 40 M

9. Line Printer Controller (LPC).

NOTE: Show Slide (23)

a. The Line Printer Controller (LPC) provides the interface between a Line Printer (LP) and one of the two Litton computer IOE busses.
b. The controller is enabled for communication with either one or neither of the two computers by the Control and Alarm Panel (CAP) unit.
c. LPC-to-Computer Interface.

(1) IOE major channel addressing of the LPC cards is by physical cable connection onto the major channel #1 for both LPC cards.
(2) The LPC address is configured to an IOE minor channel address as follows.

(a) LPC-A is on minor channel 2.
(b) LPC-B is on minor channel 3.
(c) The minor channel is defined by card slot wiring.

d. LPC-to-IOE/CAP Interface.

NOTE: Explain that the LPC-to-IOE/CAP interface is identical to the VDTC-to-IOE/CAP interface just discussed, with the exception of the deletion of the master reset signal.

e. LPC-to-Printer Interface.

(1) The LPC meets the requirements with a maximum cable length of 25 feet from the line printer.
(2) The signal interface between the LP and LPC are described as the following.

(a) Data Lines (single-ended to LP).

1. Seven lines are used for the purpose of transmitting ASCII coded information from the LPC to the LP.
2. The seven lines transmit IOE data bits 0 through 6.
3. Parity line (P) is used for the purpose of transmitting odd parity to the LP with each character.

(b) Data Request (differential from LP).

1. This signal is used by the LP to indicate that it is ready to accept data from the LPC.
2. This signal is transmitted with its complement for differential reception.

(c) Data Strobe (differential to LP).

1. This signal is used by the LPC to indicate to the LP that data is stable on the data lines.
2. This signal is transmitted with its complement.

(d) Printer Fault (single-ended from LP).

1. This signal indicates to the LPC that the LP has detected a fault(s).
2. The fault(s) may be faults such as broken paper continuity, low or empty paper supply, or printer power supply fault.

(e) All interface signal lines between the LPC and the LP utilize a twisted-pair wire.

1. The twisted pair has a nominal impedance of 110 ohms.
2. The twisted pair consists of a signal line and its complement (signal and return).

(f) Data Exchange.

1. The LPC transmits data to the LP only when the data request line is enabled.
2. When the LPC detects that the data request line is disabled, the LPC will not request data from the computer.

3. When data is received from the computer, the LPC places the data on the information lines to the LP accompanied by a data strobe.
4. Buffering of data is not allowed.
5. When the LPC detects a fault from the LP, the LPC goes into the inactive state and will remain in the inactive state until the fault from the LP is cleared.
6. The printer fault bit of the LPC status byte is set to indicate the fault condition as well as indicating that an in-transit character may be lost due to the fault condition.

f. Reset Condition- The LPC performs a reset (initiates its control logic) when any one of the following three conditions occur.

(1) Power-Up.
(2) Master Reset (Command-Enable reset).
(3) DEV Reset.

g. Power Interface.

(1) The LPC utilizes the following voltages and current.

(a) +5 volts, not to exceed 2.2 amperes.
(b) -15 volts.

(2) The -15 volts is used only by the power-on reset circuitry.

h. Cable Interface.

(1) CAP/Controller nest to line printer A uses cable W210 P2.
(2) CAP/Controller nest to line printer B uses cable W210 P3.

NOTE: Recapitulate key points. Ask questions to ensure student understanding of material covered.

QUESTIONS: What cable connects the LPU to CAP/ controller nest?
(ANS: W210).

What IOE channel is LPU-A on?
(ANS: 12 Major channel 1, Minor channel 2).

What type of wire does the interface signal lines between the LPU and the LPC?
(ANS: Twisted pair).

4 H

9. Storage Device Unit Controller (SDUC)/Floppy Disk Drive Controller (FDDC).

NOTE: Show Slide (24)

a. The SDUC acts as an interface device between the Central Processor's Input/Output Exchanger (IOE) bus and the Small Computer System Interface (SCSI) bus.

(1) The IOE is a multiplexed data channel which is part of the processor.
(2) The SCSI is a standard bus specification which many vendors of Winchester, optical, and floppy disks and bubble and solid-state memories have adopted.

b. SDUC-to-IOE/CAP Interface.

NOTE: Explain that the SDUC-to-IOE/CAP interface is identical to the VDTC-to-IOE/CAP interface just discussed.

(1) Each SDUC has two IOE major channel interfaces, one from each processor.
(2) The SDUC uses one minor IOE channel address on the interface.

(a) The minor channel is selected by backplane wiring.
(b) The major IOE channel is selected by cabling.

(3) To govern the data rate or bandwidth of the IOE minor channel, the SDU responds to commands from the processor to set its rate.

(a) The rates are from 1k word per second to 125k words per second.
(b) The default is 32k words per second.
(c) Note that, although the IOE bus rate can be set to 125k words per second, the IOE bus presently has a maximum bandwidth of 100k words per second.
(d) Therefore, if the rate were set to 125k words per second, the effective bandwidth would be a maximum of 100k words per second.
(e) This is software-controlled.

(4) The SDUC can communicate with the processor over the IOE bus with a maximum cable length of 50 feet.

(5) IOE Addressing for All SDUCs.

(a) SDUC A Interface Address = Major channel 4 and minor channel 2.
(b) SDUC B Interface Address = Major channel 4 and minor channel 3.
(c) SDUC C Interface Address = Major channel 4 and minor channel 4.
(d) SDUC D Interface Address = Major channel 4 and minor channel 5.
(e) SDUC E Interface Address = Major channel 4 and minor channel 6.
(f) SDUC F Interface Address = Major channel 4 and minor channel 7.

c. SDUC-to-SCSI Interface.

(1) SCSI Interface Signals Between the SDUC and the SDU.

(a) Busy (BSY) - An "OR-tied" signal that indicates that the bus is being used.
(b) Select (SEL) - A signal used by an initiator to select a target or by a target to reselect an initiator.
(c) Control/Data (C/D).

1. A signal driven by a target that indicates whether control or data information is on the data bus.
2. True (active) indicates control.

(d) Input/Output (I/O).

1. A signal driven by a target that controls the direction of data movement on the data bus with respect to an initiator.
2. True (active) indicates input to the initiator.
3. This signal is also used to distinguish between selection and reselection phases.

(e) Message (MSG) - A signal driven by a target during the message phase.
(f) Request (REQ) - A signal driven by a target to indicate a request for a REQ/ACK data transfer handshake.
(g) Acknowledge (ACK) - A signal driven by an initiator to indicate an acknowledgment before a REQ/ACK data transfer handshake.
(h) Attention (ATN) - A signal driven by an initiator to indicate the attention condition.
(i) Reset (RST) - An "OR-tied" signal that indicates the reset condition.
(j) Data Bus (DB 7-0) - Eight data-bit signals form a data bus.

1. DB7 is the most significant bit and has the highest priority during the arbitration phase.
2. Bit number, significance, and priority decrease downward to DB0.
3. A data bit is defined as one when the signal value is true, and is defined as zero when the signal value is false.

(k) Data parity DB(P) is odd.

(2) Blocks of data are transferred over this asynchronous, 8-bit, parity-detected bus one byte at a time.
(3) The SCSI bus is a single initiator/ single target implementation using the single-ended driver and receiver configuration with a maximum data rate of 1.5 Mbytes per second.
(4) In the MS, only one SDU device is terminated on each SDUC/SCSI bus.
(5) Each SDUC in the system has a unique SCSI bus interface to an SDU.
(6) For purposes of this discussion, the SDU is considered the target or logical unit and the SDUC is considered the initiator.
(7) The SDUC employs a single-ended driver and receiver configuration for its SCSI interface, which limits its data rate to 1.5 Mbytes per second maximum.
(8) The SDUC can communicate with the SDU over the SCSI bus with a maximum cable length of 18 feet.

d. Cable Interface.

(1) CAP/Controller nest to SDU A and SDU B uses cable W213 P2 and P3.
(2) CAP/Controller nest to SDU C and SDU D uses cable W214 P2 and P3.
(3) CAP/Controller nest to SDU E and SDU F uses cable W215 P2 and P3.

NOTE: Recapitulate key points. Ask questions to ensure student understanding of material covered.

QUESTIONS: What type of interface is between the SDUC and the SDU?
(ANS: SCSI).

What is the IOE channel for SDUC-F?
(ANS: 47, Major channel 4, Minor channel 7).

What is the effective bandwidth of the IOE bus to the SDU controllers?
(ANS: 100k words per second).

What is the cable used to interface the SDUs A and B and the CAP/controller nest?
(ANS: W213 P2 and P3).

4 H 30 M

10. CAP/Controller Nest System Maintenance - Printouts and Diagnostic Routines.

NOTE: 1. The remainder of this lesson will concentrate on CAP maintenance.
2. The individual controllers' maintenance is or has been discussed in their respective lessons.

a. CAP-Related Printouts.

NOTE: Show Slide (25)

Refer students to TM 11-5805-790-12-4, para 5-44, page 5-352. CAP/Controller Nest Printouts, and discuss.

(1) RLBK.
(2) ERR.
(3) PASS.
(4) Fail.
(5) CAP SHLTR.
(6) On-Battery loss is active on three conditions.

(a) Loss of prime ac power.
(b) Regulator/Battery charger failure.
(c) Maintenance circuit breaker open.

b. Diagnostic Routines.

1. DCAP.

(a) A helpful tool in troubleshooting is the DCAP program, which will diagnose the control and alarm panel.
(b) This program should be used when directed by the CAP M&FI procedures.

NOTE: 1. Read this warning to the students.

WARNING: When doing the DCAP test, there is an interruption of service. If the system is still transmitting and receiving messages, wait until there is a chance to perform DCAP without disrupting any messages.

2. Refer students to TM 11-5805-790--12-8, para 11-8, page 11-77 for troubleshooting flow char and DCAP M&FI Manual Procedures, and discuss.
3. The manual mode checks out the shelter alarms where you have to generate the alarm manually.
4. The automatic mode does not check out the shelter alarms; it skips these tests.

c. DCAP Procedure.

(1) Place the PROCESSOR SELECT switch on the CAP to PROC-1.
(2) Press the INIT Button.
(3) Install PLD A into FDD A.
(4) Put Processor 1 thumbwheels to 10.
(5) Press the Restart button.
(6) Hit PROGRAM LOAD twice on CAP panel.
(7) Put Processor 1 thumbwheels to 11.
(8) After load complete, 777001 and 000001 alternate in the DIAGNOSE STATUS window of the processor performing the test.
(9) Repeat steps (1) to (8) for Processor 2
(10) Enter 01 in thumbwheels on Processor 1.
(11) DIAGNOSE STATUS lights alternate 777000 and 000000.
(12) Enter test type in thumbwheels on PROC 1 (00 = Automatic) or (77 = Manual).

(a) Run the Manual Test on PROC 1.
(b) The Manual Test (77) runs the Automatic Tests 1-11 and then requires operator intervention for the remaining tests.
(c) The Automatic Test (00) only runs tests 1-11.

(13) During test 1, the OFF LINE lights for PROC-1 and PROC-2 flicker off and then back on twice.

(14) During test 10, the STBY light for PROC-1 is lit.
(15) For test 12, shelter alarm conditions have to be induced. Diagnose code alternates between 000021 and 777021.
(16) Generate an OPEN DOOR Shelter Alarm.

(a) Alarm light flashes.
(b) Audible alarm sounds.

(17) Press the CAP ALARM TEST/RESET button.

(a) Alarm light becomes steady on.
(b) Audible alarm silences.

(18) Set PROGRAM TEST switches to:

(a) 21 if the TEST passed.
(b) 31 if the TEST failed.
(c) Diagnose code displays 000000, and then momentarily 444444.
(d) Diagnose code alternates between 000022 and 777022.
(e) This input is required for the processor to give an accurate final DIAGNOSE CODE.

(19) Close the Shelter Door. Alarm light extinguished.
(20) Generate a HIGH TEMPERATURE alarm by removing plenum cover. At TB1 on A58 disconnect wire from terminal 7A.

(a) Alarm light flashes.
(b) Audible alarm sounds.

(21) Press the CAP ALARM TEST/RESET button.

(a) Alarm light becomes steady on.
(b) Audible alarm silences.

(22) Set PROGRAM TEST switches to:

(a) 22 if the TEST passed.
(b) 32 if the TEST failed.
(c) Diagnose code displays 000000, and then momentarily 444444.

(d) Diagnose code alternates between 000023 and 777024.
(e) This input is required for the processor to give an accurate final DIAGNOSE CODE.

(23) Reconnect wire to terminal 7A at TB1 on A58. Replace plenum cover. Alarm light extinguished.
(24) Generate an ON BATTERY alarm by shutting off the REGULATOR CHARGER switch at the Power Control Panel.

(a) Alarm light flashes.
(b) Audible alarm sounds.
(c) Power Control Panel Audible alarm sounds.
(d) REGULATOR CHARGER ON light extinguishes.
(e) EMERGENCY POWER lamp lights.

(25) Press the CAP ALARM TEST/RESET button.

(a) Alarm light becomes steady on.
(b) Audible alarm silences.

(26) Set PROGRAM TEST switches to:

(a) 23 if the TEST passed.
(b) 33 if the TEST failed.
(c) Diagnose code displays 000000, and then momentarily 444444.
(d) Diagnose code alternates between 000024 and 777024.
(e) This input is required for the processor to give an accurate final DIAGNOSE CODE.

(27) Remove the ON BATTERY Alarm condition by turning on the REGULATOR CHARGER switch at the Power Control Panel.
(28) Generate a POWER PROCESSOR alarm by turning off both AC and DC switches on power processor PS6.

(a) Alarm light flashes.
(b) Audible alarm sounds.
(c) POWER PROCESSOR - Power-on lamp off.

(29) Press the CAP ALARM TEST/RESET button.

(a) Alarm light becomes steady on.
(b) Audible alarm silences.

(30) Set PROGRAM TEST switches to:

(a) 24 if the TEST passed.
(b) 34 if the TEST failed.
(c) Diagnose code displays 000000, and then momentarily 444444.
(d) Diagnose code alternates between 000025 and 777025.
(e) This input is required for the processor to give an accurate final DIAGNOSE CODE.

(31) Remove the POWER PROCESSOR alarm condition by turning on the AC and DC switches on power processor PS6.

(32) Generate a 24 Vdc alarm condition by opening Power Control Panel and at PS1 TB2 remove the wire on terminal 3.

(a) Alarm light flashes.
(b) Audible alarm sounds.

(33) Press the CAP ALARM TEST/RESET button.

(a) Alarm light becomes steady on.
(b) Audible alarm silences.

(34) Set PROGRAM TEST switches to:

(a) 25 if the TEST passed.
(b) 35 if the TEST failed.
(c) Diagnose code displays 000000, and then momentarily 444444.
(d) Diagnose code alternates between 000026 and 777026.
(e) This input is required for the processor to give an accurate final DIAGNOSE CODE.

(35) Remove the 24 VDC alarm condition by reconnecting the wire at terminal 3 PS1 TB2 and closing the Power Control Panel.

(36) Generate a LOSS OF AIR FLOW alarm condition by turning off Environment Control Units (ECUs).

(a) Alarm light flashes.
(b) Audible alarm sounds.

(37) Press the CAP ALARM TEST/RESET button.

(a) Alarm light becomes steady on.
(b) Audible alarm silences.

(38) Set PROGRAM TEST switches to:

(a) 26 if the TEST passed.
(b) 36 if the TEST failed.
(c) Diagnose code displays 000000, and then momentarily 444444.
(d) Diagnose code alternates between 000027 and 777027.
(e) This input is required for the processor to give an accurate final DIAGNOSE CODE.

(39) Remove the LOSS OF AIR FLOW alarm condition by turning on ECUs.
(40) The Processor now generates a SHELTER ALARM.

(a) Alarm light flashes.
(b) Audible alarm sounds.

(41) Press the CAP ALARM TEST/RESET button.

(a) Alarm light becomes steady on.
(b) Audible alarm silences.

(42) Set PROGRAM TEST switches to:

(a) 27 if the TEST passed.
(b) 37 if the TEST failed.
(c) Diagnose code displays 000000, and then momentarily 444444.

(43) DIAGNOSE STATUS lights alternate 777066 to 000066.
(44) Enter 66 in thumbwheels to cause processor to go on line.

(45) DIAGNOSE STATUS lights alternate 777015 to 000015.
(46) Enter 15 in thumbwheels to cause processor to go off line.
(47) Processor OFF LINE state light flashes.
(48) DIAGNOSE STATUS lights alternate 777076 to 000076.
(49) If panel display is okay, enter 76 in thumbwheels; otherwise enter 75.

(a) DIAGNOSE STATUS lights display 760000 when the DCAP test has passed.
(b) DIAGNOSE STATUS lights displays 750YYY when the DCAP has conditionally passed.
(c) This means that you are running, but there is another problem besides the CAPA card.
(d) If you receive a 660zzz on the DIAGNOSE STATUS display, you should replace the CAPA card.

NOTE: Recapitulate key points. Ask questions to ensure student understanding of material covered.

QUESTIONS: Before running DCAP what must you insure?
(ANS: The message switch is not processing message traffic).

What is the problem if the diagnose code is 750040?
(ANS: DLC fault).

What is the diagnose code if the CAPA card fails?
(ANS: 660XXX).

You have diagnose code of 750400 what two cards could be the problem?
(ANS: CAPC or SCGRT).

4 H 45 M

11. CAP/Controller Nest Removal and Replacement Procedures.

NOTE: Refer students to TM 11-5805-790-12-7, para 10-9, page1-18.

a. Controller Card Cage Removal.

(1) Remove power to CAP/CNTRL Panel per TM.
(2) Remove captive hardware from front of processor.

(a) Six CNA cover screws.
(b) Four screws securing CNA to equipment rack.

(3) Slide processor rack out on its slides and lock in place to allow access to controller card cage.

NOTE: Tell the students to take ESD precautions when handling all circuit cards.

(4) Depopulate the cards from the controller nest and store the cards in an ESD storage box.

NOTE: Read this warning to the students.

WARNING: To avoid personal injury and possible equipment damage, two persons are needed to remove card cage from shelter.

(5) Have the other person push the card cage out a couple of inches.
(6) Remove the four power cables and then the signal cables.
(7) Using two persons, remove the controller nest.
(8) To replace the controller nest, just reverse these simple steps.

b. CAP Panel Removal and Replacement Procedures.

NOTE: Refer students to TM 11-5805-790-12-7, para 10-10, pg. 10-20.

(1) Remove power to CAP/CNTRL Panel per TM.
(2) Remove captive screws holding the CAP panel in place.
(3) Carefully remove the cable connection on the CAP panel.

(4) To replace the CAP panel, just reverse these steps.

NOTE: Recapitulate key points. Ask questions to ensure student understanding of material covered.

5 H

12. Practical exercise.

a. Explanation to students. This is a two-part practical exercise.

(1) Part One. Using the AN/TYC-39A; TM 11-5805-790-12-1; TM 11-5805-790-12-6; TM 11-5805-790-12-7; TM 11-5805-790-12-8; and Practical Exercise, 150-74G10-/G01-LP02-PE; you will identify the 2 out of 3 faults in the processor or CAP within 30 minutes per fault.
(2) Part Two. You must correctly answer 14 out of 20 written questions pertaining to the processor and CAP/CONTROLLER nest within 1 hour.
(3) Use the TMs to obtain the requested information.
(4) When you finish the practical exercise, have the instructor evaluate your performance.
(5) If what you are required to do is not clear, ask your instructor for clarification.

NOTE: Students will perform Part One in the MP in pairs.

b. Application by students.

(1) Part One. Using the AN/TYC-39; TMs, and Practical Exercise, 150-74G10/E02-LP07-PE; the students will identify 2 out of 3 faults on the processor or CAP within 30 minutes per fault.
(2) Part Two. Using the TMs and Practical Exercise, 150-74G10/E02-LP07-PE; the students will correctly answer 14 out 20 questions pertaining to the processor and CAP/CONTROLLER nest in 1 hour.

c. Evaluation. During Part One of the practical exercise, evaluate each student to ensure they have the ability to identify faults in the processor and CAP. During Part Two, evaluate each student to ensure they can answer at least 14 out of 20 written questions pertaining to the processor and CAP within 1 hour.

17 H 55M

SUMMARY: This concludes the lesson on the L3050V processor and CAP/Controller nest. In this lesson, we discussed the AN/TYC-39A processor and CAP/Controller nest. The exams in this course will require a knowledge of the material covered in this lesson.

18 H END

This document supports Task Number 113-603-3220 and 113-603-3224.

ANSWER KEY

1. 152 watts.
2. Eight (8) megabytes.
3. Slot 13, CAP/CONTROLLER Nest.
4. PS6 AND PS7.
5. 17.
6. Pin 105.
7. Channel 3.
8. Interfaces the CAP with the DCS on the peripherals.
9. Fifty (50) feet.
10. Resistor terminations for major channels 1 and 4.
11. SDUC-B.
12. Input/Output SCSI link.
13. Eight (8).
14. Major channel 3.
15. 32.
16. 19.2K.
17. 12.
18. W210, CAP/CONTROLLER-P1, LP-P3.
19. 4.
20. W205 and connects to the DLC/ILI nest.

U.S. ARMY SIGNAL CENTER AND FORT GORDON
FORT GORDON, GEORGIA 30905

LESSON PLAN

TITLE: AN/TYC-39A Database

LEARNING OBJECTIVE:

ACTION: The student will write a database using raw data and enter the database using the VTOF utility routine and validate the database using the TGEN job.

CONDITION: The student is given a student guide, TM-11-5805-790-12 series, AN/TYC-39A, and network worksheets.

STANDARD: The student has met the learning objective when he/she can correctly write a database within 1 hour and can correctly validate that database within 1 hour.

SAFETY CONSIDERATIONS: There are no safety considerations for this lesson.

RISK ASSESSMENT: LOW.

RESOURCE NEEDS/ REFERENCES: AN/TYC-39A, Student Guide TM 11-5805-790 Series, Program Load Device (PLD-B), 3.5 HD diskette, MS-DOS PC with ASCII editor, completed database worksheets, overhead projector, and slides 1-21.

METHODS OF INSTRUCTION: Conference and Practical Exercise

TIME: 20 hours

APPROVAL DATE: DEC 11,1997
DEVELOPER: SSG Shank
DIV. CHIEF: Jack P. Rondon

INSTRUCTOR NOTES:

1. Ensure that the classroom is available and properly set up and that all equipment and training resources are available and in working order.
2. Ensure that enough technical manuals and Student Guides are available and account for all slides.
3. State all safety notes as they appear throughout the lesson plan.

INTRODUCTION:

Elapsed Time:

1. To successfully operate the AN/TYC-39A, you need a good working knowledge of database commands and procedures. In this lesson, we will study the database commands and database worksheets that are used to develop and install data circuits.
2. Describe the data entry procedures for the database commands used in the AN/TYC-39A.
3. Write a database using raw data provided by your instructor.
4. Create a Database Device (DBD) using the VTOF job.
5. Validate the database and create a new PLD using the Table Generate (TGEN) job.

5 M

BODY:

1. AN/TYC-39A Database Sections.

   a. The AN/TYC-39A database is broken into two sections.

   NOTE: Show Slide 1.

      (1) SSO Security Section - Created by SSO type user. The security section of the database is made up of the following commands:

         (a) PASS.
         (b) UCHG.
         (c) UDEL.

(2) Line Classmark Section - Created by ADMIN type user. The line classmark section of the database is made up of all database commands that are not part of the security section of the database.

b. The two sections of the database are separate from each other and must be performed by different user types.
c. The SSO security section does not get erased or affected in any way by commands done in the line classmark section.
d. The line classmark section does not get erased or affected in any way by commands done in the security section.
e. Both sections are written to the PLD via the TGEN job, but not at the same time since different user types are required.

NOTE: Restate key points. Ask questions to ensure student understanding of material covered.

10 M

2. Initial TGEN Job.

NOTE: Show Slide 2.

a. The AN/TYC-39A master PLDs you receive with your switches may be an initial PLD.
b. If this is the case, an initial TGEN must be performed in order for you to be able to build a database and use your system.

(1) The initial PLDs contain:

(a) A master password of MTEMP$.
(b) A user ID and password of "ISSO" and "PASSWORD$".

(2) An initial PLD allows you to perform only the following jobs:

(a) MSLD - Reloads standby processor.
(b) LFIM - M&FI software package.

(c) LGON - You must log on when using the initial PLD with user ID of "ISSO" and password of "PASSWORD$".
(d) TGEN.

(3) After you log on, you should enter TGEN.

(a) If you TGEN, you may only enter the following commands:

1. PASS - To define a new master password (other than MTEMP$).
2. UCHG - To define a new user ID and password (other than ISSO and PASSWORD$).
3. UDEL - To delete users (only if you have defined them).

(b) During this initial TGEN, your input is from VDT.
(c) During initial TGEN, the following must be defined:

1. A new master password.
2. A new SSO user.

(d) The definition of a user type ADMIN may be preferred during initial TGEN.

(4) Once this initial TGEN is completed, the PLD may be used to perform other jobs; but you must either reload or perform an MSLD job first.

c. The initial PLD procedures described above are only needed if the PLD is an initial PLD; i.e., the PLD's only functional password is MTEMP$ and its only user ID and password is ISSO PASSWORD$.
d. The MTEMP$ master password and the ISSO user are not copied to the new PLD; your new PLD contains only what you defined during your initial TGEN job.

NOTE: Restate key points. Ask questions to ensure student understanding of material covered.

20 M

3. Generating AN/TYC-39A Database on a Personal Computer (PC).

NOTE: Show Slide 3.

a. The addition of the FDD to the AN/TYC-39A has brought about a major change in the way we enter database commands.
b. Database commands are entered into a PC, written to a 3.5-inch High Density (HD) disk, and later read by the message switch.
c. The PC requirements are as follows.

(1) An MS-DOS type machine.
(2) A 3.5-inch HD disk drive.
(3) An editor that produces ASCII file (for example DOS-edit or multi-edit).

d. The file that contains the database produced by the PC must have the following.

(1) A file name of "DBCMD.PCF".
(2) A carriage return and linefeed at end of each line (return key).
(3) An end-of-file mark after last command (This is editor-specific.).

e. Once the file is saved onto an HD 3.5-inch floppy, it is then inserted into the AN/TYC-39A floppy disk drives.
f. The VTOF job is used to convert the file into a file that is ready for TGEN.

(1) The generate function of the VTOF job is used to read the PC-generated floppy disk and then write a DBD.
(2) The PC-generated disk cannot be read directly by the TGEN job.
(3) The output DBD from the VTOF job is non-validated.
(4) Modifications or problems with the database that show up during TGEN job are updated on the PC file and then read back into the VTOF job.
(5) The editors used with PCs should be more powerful and user friendly than the VTOF job editing.

NOTE: Restate key points. Ask questions to ensure student understanding of material covered.

30 M

4. Database Device (DBD) - VDT to Floppy (VTOF) Job.

NOTE: Show Slide 4.

a. This job is used to perform the following functions to a floppy disk; specifically, a DBD.

(1) List.
(2) Generate.
(3) Update.

b. A separate DBD is developed for each section of the database.
c. When this DBD is used during the TGEN job, it is for either the security section or the line classmark section of the database.
d. This utility is used to meet user requirements to place database command records on floppy disk and to comply with required formats.
e. VTOF Job Equipment Requirements.

(1) VDT.
(2) Line Printer.
(3) Floppy Disk Drive(s).

f. There are three separate functions within the VTOF job.

NOTE: Show Slide 5.

(1) List an existing floppy disk and produce a printout of its contents.
(2) Generate a new database device on floppy disk from operator input.
(3) Update an existing database device, making any operator-directed additions or deletions.

g. The DBD produced by the VTOF job is non-validated. Validation is performed by the TGEN job.
h. Operating Procedure and Printouts.

(1) To edit, generate, or update a database device, enter the following at the NEXT JOB prompt: VTOF.
(2) This job is performed by user types SSO and Administration/Supervisor.
(3) In response to the ENTER FUNCTION (L=LIST, G=GEN, U=UPDATE) = ? prompt, the operator responds with one ASCII character representing the desired function.

(a) L = List existing DBD.
(b) G = Generate a new DBD.
(c) U = Update an existing DBD.

NOTE: Refer students to TM 11-5805-790-12-5 para 6-30, page 6-26, VTOF Functions, and discuss with the students.

NOTE: Restate key points. Ask questions to ensure student understanding of material covered.

1 H

5. Table Generator (TGEN) Job.

a. TGEN Overview.

NOTE: Show Slide 6.

(1) TGEN provides the means to initialize and/or modify parts of the site-specific database.
(2) The function is available off-line and on-line.
(3) Off-line is primarily used to create or modify the site-specific database classmarks and produce a new PLD containing all the programs and the newly generated/updated database.
(4) Most database parameters can also be modified on-line.

NOTE: Refer students to TM 11-5805-790-12-5 para 6-43, page 6-60.

(5) The on-line TGEN commands are entered via the VDT or a DBD.

(6) The DBD must have been previously generated by the on-line DBD generation function (GOST) or by the VTOF utility.
(7) On-line database changes are recorded in memory and on the control SDU for recovery (not on the PLD).
(8) In order to keep the PLD database up-to-date with the on-line changes, the operator must run the off-line TGEN job to record the changes on the PLD.
(9) Unless noted otherwise, the command formats and permissible values are identical on-line and off-line.

b. On-line TGEN.

(1) On-line TGEN commands are entered via the VDT or a DBD.
(2) On-line database changes are recorded in memory and on the control SDU for recovery (not on the PLD).
(3) The on-line DBD generation function (GOST) may be used to record all on-line database changes.

(a) This DBD may later be used as input to off-line TGEN to update the PLD database.
(b) In case of a system reload, in which the database is not recovered and a new PLD has not yet been generated, the DBD may also be used as input to the on-line system (once reloaded) to bring the database to its former state.
(c) It is recommended that this function be active at all times (provided an FDD is available) to record the on-line database changes.
(d) If security section database commands are written to the on-line DBD, then a user type SSO must read those command numbers back in.
(e) The line classmark commands are read back in by a user type ADMIN.
(f) If commands are mixed, they will have to be read back in by the correct user type and by number.

(4) If it’s impossible to use on-line DBD (GOST), the database command numbers given in the ACK printouts and the DBD close printouts will assist the operator in identifying the commands which have not been recorded on the DBD to minimize the effort involved in updating the PLD database.

(5) The following commands are used to activate or deactivate the on-line DBD generation function:

(a) GOST - Ghost (Write) database generation (TGEN) command to DBO. (This is the old "SCO" tape.).

1. This command may be entered by user types SSO and ADMIN/SUPE.
2. Initiates Auto-DBD mode (FDD = WD) where all valid TGEN commands will be written to an output command file on floppy disk (DBO). (This is the old "SCO".).
3. The commands are stored in a buffer and written after every 10 records or when the function is closed.
4. If no device (floppy) is available for this function, the 'NDA' alarm and "NO FDD" printout will occur, and TGEN commands will be rejected.
5. This is a SUPE command (should not be preceded by a RICH command).

(b) NOST - Negate ghost of database generation commands to DBO.

1. This command may be entered by user types SSO and ADMIN/SUPE.
2. Terminates write of TGEN commands to DBO.
3. Causes automatic close of active DBO floppy, if any.
4. This is a SUPE command (should not be preceded by a RICH command).

(6) On-line TGEN commands may be preceded by a "RICH" command line. (They are no longer preceded by *.).

NOTE: Show Slide 7.

(a) The SUPE command, RICH, must be used if the TGEN command input device is a DBD.
(b) If any password(s) are required for the TGEN commands on the DBD, they must be included in this RICH command.
(c) The RICH command must also be used to specify the password(s) required for a TGEN command which is input from the VDT.
(d) In other words, the only commands which may be entered without the RICH command are VDT input commands which require no passwords. (No * is allowed.).

(7) To specify input parameters and passwords for database generation, the following command is used: RICH i(nnnn) Mxxxx$ Sxxxx$ Exxxx$ Xxxxx$ Txxxx$ Axxxx$ Yxxxx$ Dxxxx$ Jxxxx$ where:

RICH	=	Command Designator.
i(nnnn)	=	Input to follow from:.
V	=	VDT.
D	=	Database Device.
Dnnnn=	Database device starting with Record Number nnnn.	
Mxxxx$	=	Master Password (four printable characters).
Sxxxx$	=	Security Password (four printable characters).
Exxxx$	=	ECP Password (four printable characters).
Xxxxx$	=	SPECAT/SHD Password (four printable characters).
Txxxx$	=	TRC Password (four printable characters).
Axxxx$	=	ALLIED/US Password (four printable characters).
Yxxxx$	=	SPECAT/SHD or Y Community Text Print Password (four printable characters).
Dxxxx$	=	Memory or SDU Dump Password (four printable characters).
Jxxxx$	=	Date and Time Change Password (four printable characters).

(a) This command may be entered by user types SSO and ADMIN/SUPE.
(b) This command has two functions.

    1. Specifies the input device for TGEN commands (and, if DBD (floppy), the first record to be read).
    2. Enters the required passwords if Password, Security, ECP, SPECAT/SHD, TRC Authorization, and/or ALLIED/US classmark changes are to follow.

(c) If database device (D) is specified as the input device, a database command input device must currently be open. (Open DBI command already performed.).
(d) If no record number is provided, the input begins with the first record on the device.
(e) TGEN commands will be read and processed (usually one command per record) from the DBD (FDD = RD) until either an error is detected in one of the commands, end-of-file is encountered, or a block cannot be read. In this last case, the message UNABLE TO READ BEYOND RECORD # xxxxxx appears on the printer.
(f) If VDT (V) input is specified, a second line consisting of one TGEN command may follow.

    1. This means that 2-line commands such as RADD/RAD* and RMOD/RMO* cannot be used with the RICH command and, therefore, must not include any fields for which passwords are needed (e.g., security).
    2. That is, sometimes two steps are required:

        a. Enter a 2-line command without password-type fields.
        b. Enter a second command (one line) for the password-type field.

(g) If the master password is specified (Mxxxx$):

1. No other passwords are required.
2. Exception: If a PASS command is to be used to change the value of one or more passwords (i.e., rather than to define a password for the first time), the current value of each password to be changed must appear in the RICH command line.

(8) The ACK/NAK line on the VDT and printer contains the database command number(s) assigned as a result of the command(s) processed. This additional information appears as follows:

```
NONE.
DB CMD #(S) ASSIGNED:     nnnn.
```

Standard ACK/NAK information nnnn to mmmm where:

```
NONE =    No valid DB commands entered.
nnnn =    First or only DB command number
          assigned.
mmmm =    Last DB command number assigned.
```

NOTE: Two-line commands (RADD/RAD*, RMOD/RMO*) result in one DB command number. Range of command numbers can only occur for DBD input.

(9) A command error is indicated on the printer (in addition to the SUPE NAK) in the following format:

```
(line 1)  command record.
(line 2)  *.
(line 3)  error message  RECORD # = nnnnnn.
```

(a) Line 1 is simply the command in which the error has been detected, with any passwords overlaid with dollar signs ($).
(b) Line 2 contains a single asterisk (*) in the character position at which the command scan first detected an error.

1. Usually (but not always), this is directly below the error field.
2. An asterisk beneath character 1 of the command means that the error was not noticed until after all the fields had been scanned.

(c) Line 3 consists of a brief message describing the type of error and the number of the record in error (only appears if DBD input).

(d) If an error is detected on-line while attempting to read a database device (either in the RICH D command or in one of the DBD command records), the DBD is closed.

1. If the operator wants to resume processing the DBD, it must first be re-opened by entering the OPEN DBI command, then a new RICH D command must be entered.
2. The DBD processing will start at the beginning of the file unless the operator specified the record number of the next command desired in the RICH D command.
3. Operationally, any commands which were accepted prior to the error (indicated by the record number in the error printout) should be bypassed if the DBD file is entered a second time.
4. This will prevent the possibility of additional errors resulting from database changes which have already been implemented.

(e) A command error in the first of two command lines causes the second line to be ignored and an error in the second line causes changes specified in the first line not to be effected.

c. Off-Line TGEN.

NOTE: Show Slides 8 and 9.

(1) Off-line TGEN is used to create or modify the site-specific database classmarks and to produce a new PLD containing all the programs and the newly generated/updated database.
(2) The job ID is "TGEN".
(3) Off-line TGEN commands are entered as individual command lines (i.e., they are not preceded by a RICH command).
(4) Equipment Requirements.

    (a) VDT.
    (b) Printer (optional).
    (c) Two floppy disk drives.

        1. One for the current PLD and one for a formatted floppy which will become the updated PLD.
        2. One of these drives must also be used for the DBD if commands are to be input from floppy; however, once the DBD read is complete, this drive can be used for one of the PLD functions.
        3. The function names are:

            a. IPL1 (Input PLDB1).
            b. OPL1 (Output PLDB1).
            c. IDBD (Input Database Device Command File).

(5) If TGEN is entered by a user type SSO, then TGEN only accepts security database commands.
(6) If TGEN is entered by a user type ADMIN, then TGEN only accepts non-security (line classmark) database commands.
(7) Sometimes TGEN is run twice - once for user type SSO and once for user type ADMIN.
(8) The two sections of the database do not overlap each other.

    (a) Security commands are separate from line classmark commands.
    (b) H T command does not initialize the security command tables.

NOTES: 1. Show Slide 10.
2. Refer students to TM 11-5805-790-12-5 para 6 37, page 6-43, TGEN Operating Procedures and para 6-40 page 6-53, TGEN Error Messages, and discuss.

NOTE: Restate key points. Ask questions to ensure student understanding of material covered.

1 H 30 M

6. AN/TYC-39A Database Basic Commands.

a. Set Basic Switch Parameters.

NOTE: Show Slide 11.

(1) H■T Command mnemonic.
(2) If used, this cmd must be the first cmd.
(3) It is only allowed off-line.
(4) This command initializes ADMIN tables.
(5) Changes specified by each field are effected as soon as that field is validated.
(6) This command may be entered by user type ADMIN/SUPE.
(7) Command format:

H■T Cxxx SWITCHnnn TDLSnn where:

(a) Cxxx - Communities served by this switch.

1. VALUES: R and U required; Y optional.
2. ALLOWED: Yes.
3. REQUIRED: Yes.
4. DEFAULT: N/A.

(b) SWITCHnnn - Switch number.

1. VALUES: 1 – 126.
2. ALLOWED: Yes.
3. REQUIRED: Yes.
4. DEFAULT: N/A.

(c) TDLSnn - Loop speed for TDMX lines in KB/second.

1. VALUES: 16 or 32.
2. ALLOWED: Yes.
3. REQUIRED: No.
4. DEFAULT: 32.

b. Set Switch Equipment Parameters.

NOTE: Show Slide 12.

(1) HEQP - Command mnemonic.
(2) Changes specified by each field are effected as soon as that field is validated.
(3) This command may be entered by user type ADMIN/SUPE.
(4) Command Format: HEQP VDT=Axx LPU=Ax TDIM=x TEDS=xxx TSB=x where:

(a) VDT=Axx - VDTs in system.

1. VALUES: B, C, or spaces and VDT A must be present.
2. ALLOWED: Yes.
3. REQUIRED: No.
4. DEFAULT: Current value.

(b) LPU=Ax - LPUs in system.

1. VALUES: Must be B or space, LPU A must be present.
2. ALLOWED: Yes.
3. REQUIRED: No.
4. DEFAULT: Current value.

(c) TDIM=x - TDIMs in system.

1. VALUES: Y or N; must be Y if circuit switch interface or TDMX lines to be defined. N implies TEDs and TSBs not in system.
2. ALLOWED: Yes.
3. REQUIRED: No.
4. DEFAULT: Current value.

(d) TEDS=xxx - TED connectivity.

1. VALUES: Must be three entries, each = A, B, Y, or N. First entry for

TED 1, second for TED 2, and third for TED 3.

a. A = Connected to TDIM-A.
b. B = Connected to TDIM-B.
c. Y = In system, not connected.
d. N = Not in system.

2. ALLOWED: If TDIMs in system.
3. REQUIRED: No.
4. DEFAULT: Current value.

(e) TSB=x - TSBs in system.

1. VALUES: Y or N.
2. ALLOWED: If TDIMs in system.
3. REQUIRED: No.
4. DEFAULT: Current value.

c. Define TDIM/NSYLK Parameters.

NOTE: Show Slide 13.

(1) HTDM - Command mnemonic.
(2) This command is permitted only if a TDIM has been marked in system via the HEQP command.
(3) The TDIM must not be available to the on-line system when this command is entered.
(4) Modification of any parameters in this command requires all fields to be entered (i.e., all fields are always required).
(5) Command format:

HTDM CH=nn CLD=x CLM=x RED REP=Y DIPHASE RTS=A NSYL=xxxxxxx.
BLK N.
DIPULSE B where:

(a) HTDM - Command mnemonic.
(b) CH=nn - Number of channels for output to circuit switch.

1. VALUES: 8, 9, 16, 18, 32, 36.
2. ALLOWED: Yes.
3. REQUIRED: Yes.
4. DEFAULT: N/A.

(c) CLD=x - Cable length demodulation (in quarter miles) and loopback information.

1. VALUES: 0 = 0 mile.
   1 = 1/4 mile.
   2 = 1/2 mile (2/4).
   3 = 3/4 mile.
   4 = 1 mile (4/4).
   L = loopback mode.
2. ALLOWED: Yes.
3. REQUIRED: Yes.
4. DEFAULT: N/A.

(d) CLM=x - Cable length modulation (in quarter miles) and loopback information.

1. VALUES: 0 = 0 mile.
   1 = 1/4 mile.
   2 = 1/2 mile (2/4).
   3 = 3/4 mile.
   4 = 1 mile (4/4).
   L = loopback mode.

2. If CLD specified loopback mode, CLM must also be "L". If not loopback, CLM must be the same as CLD or it must be ■4■ (1 mile).
3. ALLOWED: Yes.
4. REQUIRED: Yes.
5. DEFAULT: N/A.

(e) RED/BLK - Red/Black TDIM.

1. VALUES: RED = Red TDIM.
   BLK = Black TDIM.
2. ALLOWED: Yes.
3. REQUIRED: Yes.
4. DEFAULT: N/A.
5. Normally RED = No TED.

(f) REP=Y/N - Repeater mode.

1. VALUES: Y = Yes (repeater mode).
   N = No (non-repeater mode).
2. ALLOWED: Yes.
3. REQUIRED: Yes.

4. DEFAULT: N/A.

(g) DIPHASE/DIPULSE - Diphase/Dipulse modulation.

1. VALUES: DIPHASE = Diphase modulation
DIPULSE = Dipulse. modulation.
2. ALLOWED: Yes.
3. REQUIRED: Yes.
4. DEFAULT: N/A.

(h) RTS=A/B - RTS connection.

1. VALUES: A = Connected to RTS A.
B = Connected to RTS B.
2. ALLOWED: Yes.
3. REQUIRED: Yes.
4. DEFAULT: N/A.

(i) NSYL=xxxxxxx - NSYLK output selection.

1. Each of the x■s in the field represents the output selection for one NSYLK (i.e., first x is for NSYLK1, second x is for NSYLK2 ... seventh x is for NSYLK7).

2. VALUES:

a. If output select is current TDIM, each x must be T.
b. If output select is modem, each x must be M.
c. At least one of the x■s must be a T.

3. ALLOWED: Yes.
4. REQUIRED: Yes.
5. DEFAULT: N/A.

d. Line ADD/MOD Command Modifications.

NOTE: Show Slide 14.

(1) The LADD and LMOD commands format is as follows.

LADD/LMOD .... Tnn MDnn LKGnn .... where.

(a) Tnn - LTU number.

1. VALUES: 0 – 47.

a. Must not equal the LTU number of any other active line.
b. Note that the LTU number now follows the LKG and modem number (using normal-through connectivity).

2. ALLOWED: Yes.
3. REQUIRED: Yes-LADD, No-LMOD.
4. DEFAULT: N/A-LADD, Current value-LMOD.
5. The LTU number field of the LADD/LMOD commands is unchanged.

(b) MDnn - Modem number.

1. VALUES:0 - 47, 99.

a. Must not equal the modem number of any other active line.

2. ALLOWED: Yes.
3. REQUIRED: Yes-LADD, No-LMOD.
4. DEFAULT: N/A-LADD, Current value-LMOD.

(c) LKGnn - LKG number.

1. VALUES: 0 – 47.

a. Must not equal the LKG number of any other active line.

2. ALLOWED: Yes.
3. REQUIRED: Yes-LADD, No-LMOD.
4. DEFAULT: N/A-LADD, Current value-LMOD.

5. The LKG field has changed but the values allowed remain at 0 - 47 (48 LKGs).

e. Router ADD/MOD Command Modifications.

NOTE: Show Slide 15.

(1) Add/Modify an RI to a local/remote terminal RI (CS/DA extension).
(2) RAD*/RMO*Continuation command mnemonic.
(3) RADD ....* RAD* .....DT=xxxxx STRnn .
(4) The default values for the DTE type codes have been changed. DT=xxxxx - Data adapter DTE type.

(a) VALUES: Any or all of the following DTE type codes may be entered; any type which is not entered will indicate that the particular characteristic is not (or is no longer) present:

1. M = Mag tape.
2. S = Display or storage.
3. C = Card unit.
4. T = Paper tape unit.
5. P = Page printer.

(b) ALLOWED: If SD or DD; must be MCT if AUTODIN DA line.
(c) REQUIRED: No.
(d) RADD DEFAULT: If SD or DD; defaults to "MCT" if AUTODIN or "STP" if not AUTODIN.
(e) RMOD DEFAULT: If connection type changed defaults to "MCT" if AUTODIN or "STP" if not AUTODIN.

(5) The Mode VI storage block value has been modified from 16 or 32 to 16, 32, 64, or 96.

(a) STRnnMode VI storage.
(b) VALUES: 16, 32, 64 or 96; must be 32 if AUTODIN DA line.
(c) ALLOWED: If DA and DTE is Mode VI.
(d) REQUIRED: If the line mode is being modified from Mode I to Mode VI.
(e) RADD DEFAULT: N/A.

(f) RMOD DEFAULT: Current value if Mode VI; else defaults to no Mode VI storage.

NOTE: Mode VI storage field (STRnn) defaults to 32 LB for all switch relays (SF/SN) with DD or SD classmarks. Restate key points. Ask questions to ensure student understanding of material covered.

2 H 15 M

7. Line Classmark Database Command Types
The database commands may be looked at in seven general areas, as follows.

NOTES:

1. Show Slide 16.

2. Refer students to TM-11-5805-790-12 and have them follow the database commands as you review them. Answer any questions about database command parameters as needed.
3. This should be a review for the students; however, understanding the database commands is essential throughout the remainder of this course.
4. Refer students to TM 11-5805-790-12-5 para 6-42 page 6-59, Database Command Information, and discuss with the students as you cover each section of commands.

a. Switch Parameter Commands - Commands that define switch-wide types of parameters.

(1) H■T - Set basic switch parameters.
(2) HXTS - Specify external traffic service.
(3) HCSP - Set circuit switch interface parameters.
(4) HCPU - Set circuit switch busy delay parameters.
(5) HEQP - Set switch equipment parameters.
(6) HMCB - Assign TYC-39 or TYC-39A switch relays.
(7) HRYR - Change the R/Y ratio.
(8) HTDM - Define TDIM/NSYLK parameters.

b. Line Commands - Commands that define individual lines of different types.

(1) LADD/LMOD...Mn - Define/Modify dedicated, conventional, terminal line.
(2) LADD/LMOD...DA - Define/Modify dedicated, data adapter, terminal line.
(3) LADD/LMOD...CS - Define/Modify MS-CS trunk.
(4) LADD/LMOD...SF - Define/Modify conventional MS-MS trunk.
(5) LADD/LMOD...SD - Define/Modify data adapter MS-MS trunk.
(6) LRIS - Assign special RIs to a line.
(7) LECP - Give or deny ECP authorization to a line.
(8) LDEL - Delete a line.

c. RI Commands - Commands that define routing indicators.

(1) RADD/RMOD...SF/SN - Define/Modify a new primary/nearby switch relay.
(2) RADD/RMOD...LT - Define/Modify a new local terminal RI.
(3) RADD/RMOD...RT - Define/Modify a new remote terminal RI.
(4) RADD/RMOD...SR - Define/Modify a new remote switch relay.
(5) RADD/RMOD...US - Define/Modify a new user RI.
(6) RADD/RMOD...EQ - Define/Modify an RI equated to another RI.
(7) RADD/RMOD...PA - Define/Modify a parent relay.
(8) RECP - Give or deny ECP authorization to an RI.
(9) RDEL - Delete an RI.

d. Collective Commands - Commands that define collective routing indicators.

(1) CADD - Define a new collective RI.
(2) CARI - Add members to a collective RI.
(3) CDRI - Delete members from a collective RI.
(4) CDEL - Delete a collective RI.

e. Security Definition Commands - Commands that define security.

(1) SEC LINE - Change security of a line.
(2) SEC RI - Change security of an RI.
(3) SEC TCA - Assign TCC authorizations.

(4) SEC TCD - Delete TCC authorizations.
(5) SEC TRA - Add TRC authorizations.
(6) SEC TRD - Delete TRC authorizations.
(7) SEC SRA LINE - Add SPECAT/SHD authorizations for a line.
(8) SEC SRA RI - Add SPECAT/SHD authorizations for a RI.
(9) SEC SRA TSS - Add SPECAT/SHD authorizations for TSS.
(10) SEC SRD LINE - Delete SPECAT/SHD authorizations for a line.
(11) SEC SRD RI - Delete SPECAT/SHD authorizations for a RI.
(12) SEC SRD TSS - Delete SPECAT/SHD authorizations for TSS.

f. Reintroduction Commands - Commands that define reintroduction routing indicators.

(1) REIN ADD - Add reintroduction RI for an individual RI.
(2) REIN ADD ALL - Add all community reintroduction Ris.
(3) REIN DEL - Delete reintroduction RI for an individual RI.
(4) REIN DEL ALL - Delete all community reintroduction Ris.

g. Miscellaneous Commands - Commands that define CRITIC routes and routing indicators for network control functions.

(1) CDRT - Define CRITIC deterministic routes.
(2) CSST - List RIs to receive supervisory stat messages.
(3) CDSP - List Ris to receive database display messages.
(4) CRRP - List RIs to receive routing reports.

NOTE: Restate key points. Ask questions to ensure student understanding of material covered.

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8. Typical Order of Database Commands.

a. To define a new switch database, a typical order of commands would be as follows.

NOTE: Show Slide 17.

(1) PASS (SSO section) - Define/Change Passwords.
(2) UCHG (SSO section) - Change a User ID.
(3) H■T - Set Basic Switch Parameters.
(4) HCSP (if circuit switch interface) - Set CS Interface Parameters.
(5) HCPU (if circuit switch interface) - SET CS Busy Delay Parameters.
(6) HEQP - Set Switch Equipment Parameters.
(7) HTDM (if TDIM in system) - Define TDIM/NSYLK parameters.
(8) HMCB (home switch relays required) - Assign TYC-39A Relays.
(9) HXTS - Specify External Traffic Service.
(10) HRYR (if switch serves Y community) - Change the R/Y ratio.

NOTE: Show Slide 18.

(11) LADDs - Define New Line Classmarks.
(12) SEC TRAs (R/U community) - Add TRC authorizations.
(13) SEC SRA LINEs (R/U community) - Add SPECAT/SHD authorizations.
(14) RADDs for relays - Define new RI classmarks.
(15) RADDs for SMRIs - Define new RI classmarks.
(16) RADDs for other RIs - Define new RI classmarks.
(17) LRISs - Assign special routing indicators to a line.
(18) SEC TCAs (Y community) - Add TCC authorizations.
(19) SEC SRA RIs (R/U community) - Add SPECAT/SHD authorization.

NOTE: Show Slide 19.

(20) SEC SRA TSS (R/U community) - Add SPECAT/SHD authorization for TS.
(21) CADDs - Define a new connective RI.
(22) CARIs - Add members to a collective RI.
(23) CDRT - Define critic deterministic routes.

(24) CSSTs - List RIs to receive supervisory STAT messages.
(25) CDSP - List RIs to receive database display messages.
(26) CRRP - List RIs to receive network control routine reports.
(27) REINs - Add/delete reintroduction Ris.

b. Commands are used as needed. If a command is not necessary, it need not be entered.

NOTE: Restate key points. Ask questions to ensure student understanding of material covered.

3 H

9. Sample Training Network.

NOTES: Show Slide 20.
Refer students to TM-11-5805-790-12 and have them follow the database commands as you review them. Answer any questions about database command parameters as needed.

a. The network consists of the following equipment:

(1) Two AN/TYC-39A Message Switches.
(2) One AUTODIN switch.
(3) Two dedicated CTs (mode VI terminals).
(4) Two mode II terminals.
(5) Two mode I terminals.

NOTE: Show slide 20A, Sample Training Network Databases, and review each command as follows.

b. H■T command (Set basic switch parameters).

(1) First command.
(2) Initializes line classmark database.
(3) C - Communities Served (R, U, Y).
(4) Switch #.
(5) TDLS - Loop speed for TDMX lines (16 or 32).

c. HMCB - Assign TYC-39A relays (Sites 1 and 36).
d. LADD - Line ADD.

(1) Dedicated Conventional (LADDs 1, 2, and 45).

(a) M (1-5) – Mode.
(b) U.S.
(c) T (0-47) - LTU number.
(d) MD (0-47) - Modem number.
(e) LKG (0-47) - LKG number.
(f) SP - Loop Speed (9 = 1200, 10 = 2400).
(g) G - Backlog Group.
(h) C - Communities Served (R, U, Y).
(i) J8 - Format (JANAP 8-level, ASCII).
(j) CN - Transmission Mode (Continuous).
(k) FS - Full SOM sequence.
(l) SM - Number of stop bits (2).
(m) AT - AUTODIN Access Line (Special Terminal).
(n) RSEC - R Community Security.

(2) Data Adapter MS-MS Trunk (LADD 40).

(a) SD - Line type.
(b) LK - First link (if linked).
(c) SLV – Slave.
(d) DMC - Data mode control.

(3) Conventional MS-MS trunk (LADD 41) - SF line type.
(4) Dedicated, data adapter (LADD 47) - Line type.

e. RADD - Routing Indicator ADD.

(1) Equate an RI to another RI.

(a) YUSFSV - Traffic service RI (Automatically generated in the routing tables during switch initialization).
(b) EQ – Equate.

(2) Define a new local terminal RI (basic) (lines 1, 2, 45, and 47).

(a) LT - Local Terminal.
(b) OAS - Other automatic switch indicator (AUTODIN).
(c) RE - Relay type (1 = Y community, 0-5 = R/U community.
(d) Connection type.

1. DC - Dedicated Conventional.
2. DD - Dedicated Data Adapter.

(e) D - DTE number (always 1).
(f) SEC - Security Prosign (Top Secret).
(g) LMF - Terminal Language Media Format AO - 8 level TTY only (JANAP).
(h) C - Teletype line size (80 characters).
(i) * - Continuation Indicator (required for DD lines).

(3) Define a new local terminal RI (CS/DA extension).

(a) RAD* - Continuation Command Mnemonic.
(b) m - MODE (6).
(c) EC - Error Control (0 = multisampling).
(d) FR - Framing (no).
(e) IR - Information Rate (13 = 16k).
(f) DMC - Data Mode Control (yes).
(g) STR - Mode VI Storage (96 line blocks).
(h) ECP - ECP authorization (precedence level).
(i) SM - Service Message RI.

(4) Define a new primary/nearby switch relay (basic) (line 40).
(5) Define a new primary/nearby switch relay (CS/DA extension).

f. LRIS - Assign special routing indicators to a line.

(1) SM - Service message RI.
(2) CD - Channel designator.

g. SEC RI - Change security of an RI (top secret).
h. SEC SRA TSS - ADD SPECAT/SHD authorizations for traffic service.
i. CDRT - Define critic deterministic routes.

NOTE: Restate key points. Ask questions to ensure student understanding of material covered.

3 H 30 M

10. Database and Network Construction.

NOTES: Show Slide 21.

This is an overview of what will be required in the performance exercise portion of this lesson.

a. Database.

(1) The first step in constructing a database is to write a database using the raw data provided and the TM.
(2) The second step is to enter the database using the VTOF utility routine.
(3) The third step is to validate the database using the TGEN job.

NOTE: Restate key points. Ask questions to ensure student understanding of material covered. Ensure that there are no questions on the material covered.

4 H

PERFORMANCE EXERCISE:

NOTE: 1. Assign half of the group to site 01 and half to site 02.
2. Read the instructions with the students. At the conclusion of the performance exercise, review the exercise with the students.

1. Practical Exercise.

a. Explanation to students.

(1) In Part One, you will write a database using the raw data provided.
(2) In Part Two, you must enter the database using the VTOF utility routine and validate the database using TGEN.
(3) In either part, if it is not clear what you are required to do, ask your instructor for clarification.

b. Application by students.

(1) In Part One, you will write a database using the raw data provided.

(2) In Part Two, you must enter the database using the VTOF utility routine and validate the database using TGEN.
(3) In either part, if it is not clear what you are required to do, ask your instructor for clarification.

c. Evaluation.
Evaluate students on both parts of the practical exercise. In Part One, evaluate each student's ability to correctly write a database within 1 hour. In Part Two, evaluate each student's ability to enter the database using the VTOF utility routine and validate the database using TGEN within 1 hour.

19 H 55 M

SUMMARY: In this lesson, we discussed the AN/TYC-39A database commands. We looked at the commands that are required for a minimum baseline, as well as other commands. The information you received in this lesson, combined with your prior knowledge of message switch commands, will enable you to build or modify a database if required.

20H

END

This document supports Task Number 113-603-2198.